DUDLEY KNOX LIBRARY
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA 93943-5002

NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

REDUCING REPAIR TURN AROUND TIME OF DEPOT LEVEL REPAIRABLES AT NAVAL SHIPYARDS

by

Joseph R. Rodwell, Jr.

December 1985

Thesis Advisor: Alan W. McMasters

Approved for public release; distribution is unlimited.

T226814

REPORT DOCUMENTATION PAGE

. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
. SECURITY CLASSIFICATION AUTHORITY . DECLASSIFICATION / DOWNGRADING SCHEDULE	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution is unlimited.
PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)

. NAME OF PERFORMING ORGANIZATION aval Postgraduate School	6b. OFFICE SYMBOL *(If applicable)* 54	7a. NAME OF MONITORING ORGANIZATION Naval Postgraduate School
. ADDRESS *(City, State, and ZIP Code)* onterey, California 93943-5100		7b. ADDRESS *(City, State, and ZIP Code)* Monterey, California 93943-5100
. NAME OF FUNDING / SPONSORING ORGANIZATION	8b. OFFICE SYMBOL *(If applicable)*	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
. ADDRESS *(City, State, and ZIP Code)*		10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.

TITLE *(Include Security Classification)*
EDUCING REPAIR TURN AROUND TIME OF DEPOT LEVEL REPAIRABLES AT NAVAL
IIPYARDS

. PERSONAL AUTHOR(S)
odwell, Joseph R., Jr.

a TYPE OF REPORT aster's Thesis	13b. TIME COVERED FROM ________ TO ______	14. DATE OF REPORT *(Year, Month, Day)* 1985 December	15. PAGE COUNT 139

. SUPPLEMENTARY NOTATION

COSATI CODES			18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
FIELD	GROUP	SUB-GROUP	repairables, management, depot turnaround time, Navy shipyards, Inventory Management

ABSTRACT *(Continue on reverse if necessary and identify by block number)*

is thesis examines the key issues that have caused Repair Turn Around Time (RTAT) of
ot Level Repairables (DLRs) managed by the Ships Parts Control Center (SPCC) and over-
iled by naval shipyards to be excessive. Many of the DLRs repaired by naval shipyards
ceed the Naval Supply System command's goal of 60 days. Four Navy Shipyards were visited
gather RTAT data on DLRs and identify potential improvements in the Designated Overhaul
nt (DOP) repair process that will reduce RTAT. An analysis of the policies and proce-
es used by SPCC in preparing the workload forecase as well as the effects of the fore-
t on the shipyard repair process was also conducted. Recommendations are made to improve
management of repairables in shipyards through Command support and the use of an Auto-
ed Repairables Management Information System (ARMIS). Recommendations are also offered
improve piece part support used in the repair of DLRs.

DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
. NAME OF RESPONSIBLE INDIVIDUAL an W. McMasters	22b. TELEPHONE *(Include Area Code)* (408) 646-2678	22c. OFFICE SYMBOL 54Mg

83 APR edition may be used until exhausted.
All other editions are obsolete.

Approved for public release; distribution is unlimited.

Reducing Repair Turn Around Time of Depot Level Repairables at Naval Shipyards

by

Joseph Robert Rodwell Jr.
Lieutenant Commander, United States Navy
B.S., University of South Carolina, 1972

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1985

ABSTRACT

This thesis examines the key issues that have caused Repair Turn Around Time (RTAT) of Depot Level Repairables (DLRs) managed by the Ships Parts Control Center (SPCC) and overhauled by naval shipyards to be excessive. Many of the DLRs repaired by naval shipyards exceed the Naval Supply System Command's goal of 60 days. Four Navy shipyards were visited to gather RTAT data on DLRs and identify potential improvements in the Designated Overhaul Point (DOP) repair process that will reduce RTAT. An analysis of the policies and procedures used by SPCC in preparing workload forecast as well as the effects of the forecast on the shipyard repair process was also conducted. Recommendations are made to improve the management of repairables in shipyards through Command support and the use of an Automated Repairables Management Information System (ARMIS). Recommendations are also offered to improve piece part support used in the repair of DLRs.

Thesis
R6734
c.1

TABLE OF CONTENTS

I. INTRODUCTION 10
  A. BACKGROUND 10
  B. OBJECTIVES 11
  C. METHODOLOGY 11
  D. CHAPTER OUTLINE 12
II. THE REPAIRABLES CYCLE 13
  A. BACKGROUND 13
  B. DETERMINING REPAIR REQUIREMENTS AT SPCC 17
  C. SHIPYARD REPAIRABLES CYCLE 21
  D. MAJOR SHIPYARD FUNCTIONS 27
    1. Production Control 27
    2. Funds Administration 27
    3. Planning and Estimating 28
    4. Scheduling 29
    5. Induction 30
    6. Repair In Process 32
  E. DOP REPORTING REQUIREMENTS. 34
  F. RTAT PERFORMANCE 36
  G. SUMMARY 38
III. ANALYSIS OF THE REPAIRABLES CYCLE 39
  A. GENERAL 39
  B. INSTITUTIONAL ISSUES 41
    1. RTAT 41
    2. Workload Backlog 42
  C. DOP ORGANIZATION 45
    1. General 45
    2. Proposed Organization 46
  D. WORKLOAD FORECASTING 59

E. ADMINISTRATIVE TIME 64
  1. Documentation Time 64
  2. Induction Time 65
  3. Induction Process 67
F. PIECE PART SUPPORT AND REPAIR-IN-PROCESS TIME 69
  1. Measuring RIPT 69
  2. Piece Parts 70
G. PRESERVATION, PACKAGING AND STORAGE 82
H. AUTOMATED REPAIRABLES MANAGEMENT SYSTEM (ARMIS) 83
I. SUMMARY 88

IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 89
A. SUMMARY 89
B. CONCLUSIONS AND RECOMMENDATIONS 90
  1. Institutional Issues 90
  2. DOP ORGANIZATION 92
  3. Workload Forecasting 92
  4. ADMINISTRATIVE TIME 93
  5. Induction Time and Processes 94
  6. Piece Parts and Repair-in-Process Time (RIPT) 94
  7. Preservation, Packaging and Storage . . . 96

APPENDIX A: SPCC WORKLOAD FORMS 97

APPENDIX B: RRC FUNCTIONAL FLOW CHARTS 102

APPENDIX C: LONG BEACH NSY MRP SYSTEM DESCRIPTION . . 106

APPENDIX D: LOCAL MR FUNCTIONAL DESCRIPTION 119

APPENDIX E: FUNCTIONAL DESCRIPTION OF ARMIS 124

APPENDIX F: SAMPLE ARMIS REPORTS AND FORMS 128

APPENDIX G: ARMIS HARDWARE AND TRAINING COST ESTIMATES 133

LIST OF REFERENCES 135

INITIAL DISTRIBUTION LIST 137

LIST OF TABLES

I 7H WORKLOAD BACKLOG IN UNITS 43

II HISTORY OF RTAT BY COG. FOR NSY LONG BEACH . . . 54

III REPAIR TURN AROUND TIME 55

IV DOP ADMINISTRATIVE TIMES 66

V NON-AUTOMATED DOP REPAIR IN PROCESS TIME 70

VI AUTOMATED DOP REPAIR IN PROCESS TIME 71

LIST OF FIGURES

2.1 Non-Aviation Component Repair Process 16
2.2 Flowchart of SPCC's Workload Forecasting Model . . 20
2.3 B08 Cyclic Process 22
2.4 Processing High Priority Repair Requirements . . . 23
2.5 Processing Interim Repair Request 24
2.6 Automated Customer Order Acceptance Record 26
2.7 Sample Log Sheet 29
2.8 Sample Work Estimate Sheet 31
2.9 Sample Work Control Document 33
2.10 Depot RTAT Segments 37
3.1 SPCC Backlog Computations Sample 44
3.2 NAVSEA approved Repairables Management Office . . . 48
3.3 Long Beach NSY RMO and RRC Organization 49
3.4 Electronic / Electrical RRC 51
3.5 Mechanical RRC 52
3.6 Shop Manning Requirements Sample Report 56
3.7 Consolidated Stock Status Report 62
3.8 SPCC Repair Workload Forecast 63
3.9 Elements of Administrative Time 65
3.10 DOP Requisition Process 79
3.11 DOP Receipt Process 80
3.12 Requisition and Receipt Times 81
3.13 RMO, RRC, CODS and SYMIS Interface 86

ACKNOWLEDGEMENTS

To Mr. Dave Greemore, NAVSEA 0715, whose financial backing and support made this thesis possible.

To the shipyard Production Controllers for their candid comments which provided the basis for much of this thesis and to Mr. Carolis Crespo and Mr. Mike Beliveau of SPCC for their assistance in explaining the workload forecasting process.

A special thanks to Mr. Ed Lovelace, RRC supervisor (retired), for his technical assistance and advice.

Finally, to my wife Joan, for her support and assistance.

I. INTRODUCTION

A. BACKGROUND

This thesis will examine each step in the organic depot (naval shipyard) repair cycle to determine if the repair turn around time (RTAT) of Depot Level Repairables (DLRs) managed by the Navy's Ships Parts Control Center (SPCC) can be reduced.

RTAT as used in this thesis refers to the period of time from receipt of a funding document from SPCC to the time the depot level repairable is returned to the supporting stock point in "A" condition. Although the current 90 day RTAT standard set forth by the Chief of Naval Material (CNM) in the Navy Repairables Management Manual is possible, most Navy shipyards (NSYs) are not organized to support this time frame. With increasing procurement lead times for many of the DLRs repaired by these DOPs it is imperative the Navy manage repair of scarce DLRs more effectively. In general, if the RTAT can be reduced from 90 to 60 days it will have the same effect as increasing DLR assets in the repair pipe line by 33 percent.

During the early 1980's the Naval Audit Service reviewed the repairables programs of several naval shipyards. The following excerpts highlight some of the problems that have historically caused RTAT at naval shipyards to be excessive.

> 1 NAVSHIPYD does not have a Repairables Management organization with central authority and responsibility. [Ref. 1: p. 1].
>
> 2 Fixed priced agreements with repairables program customers are not entered into the maximum extent practical. [Ref. 1: p. 6].
>
> 3 NAVSHIPYD does not provide as intensive support to the repair of items as contemplated by governing directives. Its production shops are dedicated to overhaul and repair of ships on the waterfront, and repairables work is accepted only as shop schedules permit. [Ref. 2: p. 1].

4 NAVSHIPYD does not accomplish the repair of items in accordance with repair program manager assigned completion dates or priorities. [Ref. 2: p. 1].

5 NAVSHIPYD provides erroneous data in its 2F/2S Cognizance and Secondary Item Repair Program Reports to repair program managers. [Ref. 2: p. 25].

B. OBJECTIVES

The objectives of this research effort are to:

1. Describe the policies and procedures used by SPCC to workload DLRs at organic Designated Overhaul Points (DOPs).
2. Examine the effects of workloading on the policies and procedures used at naval shipyards to repair DLRs.
3. Describe the repair cycle currently in use at naval shipyards.
4. Examine each segment of the DOP repair cycle to identify possible alternatives to current policies and procedures at both SPCC and naval shipyards for reducing repair turn around time.

C. METHODOLOGY

The initial literature search revealed many Navy Instructions and Defense Logistics Studies Information Exchange (DLSIE) reports and studies that stressed the need for the Navy to more effectively manage depot level repairables. However, these studies did not address the specific issue of how to reduce repair turn around time at naval shipyards. As a consequence, recent Naval Postgraduate School theses covering DLRs were reviewed to gain a more complete understanding of the repairables cycle and identify possible ways of reducing RTAT.

Performance information was collected by visiting four naval shipyards; NAVSHIPYD Long Beach, Mare Island, Norfolk and Charleston. A visit to SPCC was also made to gather information concerning the policies and procedures used by SPCC in workloading.

D. CHAPTER OUTLINE

Chapter II presents a description of the repair policies and procedures employed by SPCC and naval shipyards in the repair cycle. A detailed explanation of each segment of the DOP repair process is given to provide the reader with an understanding of the complexities involved, beginning with the establishment of a job to make repairs and ending with the return of a completed repaired carcass to the supply system in a ready for issue (RFI) condition. Chapter III identifies problems that have contributed to excessive RTAT at naval shipyards and explores possible alternatives to current practices used to workload and repair DLRs. Chapter IV is an executive summary of the problems and offers conclusions and recommendations based on the analyses of Chapter III.

II. THE REPAIRABLES CYCLE

A. BACKGROUND

The increasing complexity of weapons systems has caused the supply system to reevaluate the maintenance and stocking philosophy of wholesale systems assets. The life cycle cost of weapons systems has also increased. Many of these cost are directly related to maintaining assets which are repairable. An item is designated as a repairable if it is more cost effective to repair it than to procure a replacement. Historically, repairing a DLR component has been accomplished at one fourth the cost of a new item and at one third the procurement lead time [Ref. 3:p. IX-5]. Current policy is to repair if the repair cost does not exceed seventy five percent of the current purchase price. The increased cost associated with the maintenance and repair of DLRs has dictated increased attention to management of repairable components. As a result, SPCC has transferred most of the previously managed consumable items to the Defense Logistics Agency (DLA) and has concentrated on the management of DLRs.

During the acquisition process of major weapon system a decision is made concerning the maintenance of each component that makes up the system. These components are classified as either consumeable or repairable. Consumable items will be discarded when they fail or exceed their useful life and a replacement will be procured. For repairables, a Level of Repair Analysis is made to determine the lowest level authorized to repair or condemn the item. The Navy uses a three level maintenance concept. Based on technical and testing requirements of the component, repairables may be repaired at the organizational, intermediate or depot level. Organizational maintenance involves those actions that can be taken by the operating unit on a day by day basis to keep the item working. Intermediate maintenance is performed by a designated maintenance activity in support of the operating unit. Intermediate maintenance is normally accomplished by tenders, or at shore based repair facilities. These activities have the capability to perform repairs that are beyond that of the operating unit. They include such functions as calibration, field changes and replacing parts. Depot maintenance are those repairs necessary to bring a failed or damaged carcass back to original manufacturer's specification. Due to the extensive nature of the repairs and the machinery and test equipment involved, naval shipyards have been designated as the depot maintenance activities for many non-aviation DLRs.

When a system is first put into service the original equipment manufacturer (OEM) is normally designated as the interim depot for repair of DLRs. The reasoning behind this philosophy is that it is prudent to defer setting up organic depots when the system is new and subject to design changes and modifications. As the system matures and demand data is accumulated, the Hardware Systems Command (HSC) evaluates it and decides who should be the designated overhaul point (DOP). Assignment of a permanent DOP is a detailed and time consuming process made in accordance with the NAVMAT approved Depot Utilization Plan and NAVMAT Instruction 4000.41 [Ref. 3:p. IV-12]. Concurrently, inventory management responsibility is also assigned. Normally the inventory management function is assigned to NAVSUP Inventory Control Points (ICPs). It is the responsibility of the IM to manage material under their cognizance and have the item available to operating forces when and where it may be needed. As an example, in the Class Maintenance Plan for FFG-7 Class Frigates, Long Beach Naval Shipyard was designated as the overhaul depot for approximately 200 hull, mechanical and electrical DLRs. SPCC was assigned as the IM.

As repair requirements are identified the IM funds the DOP for repair. Until recently the standard time to accomplish repair has been 90 days. Due to funding constraints and increasing procurement lead times, NAVSUP now wants repair turn around time (RTAT) reduced to 60 days [Ref. 4]. If this can be accomplished it will have the same effect as reducing the number of failed carcasses required in the repair pipeline by one third. If RTAT for all DLRs can be reduced to 60 days the Navy may realize savings amounting to more than 180 million dollars, (average daily demand for DLRs is approximately three million dollars) [Ref. 4]. If this goal can be obtained, the Navy can not only save a great deal of money but can also improve fleet support and readiness. In order to accomplish this task Naval Sea Systems Command (NAVSEA) and NAVSUP must work together identifying and eliminating wasted or unnecessary time in the repair cycle.

As indicated in Chapter 1, this thesis will look at what NAVSEA and, in particular, naval shipyards can do to achieve a 60 days RTAT. To accomplish this it is first necessary to briefly review the segments of the current repair cycle at both SPCC and naval shipyards in detail. The cycle is defined for this thesis as the time from when a repair requirement is generated by the IM to the completion of repairs by the shipyard and a completed DLR is returned to the Designated Support Point (DSP). A DSP is normally the Naval Supply Center (NSC) nearest the DOP. Figure 2.1 is a flowchart of the non-aviation component repair cycle [Ref. 3]. The numbers in parenthesis are the sequence of events in the repair cycle.

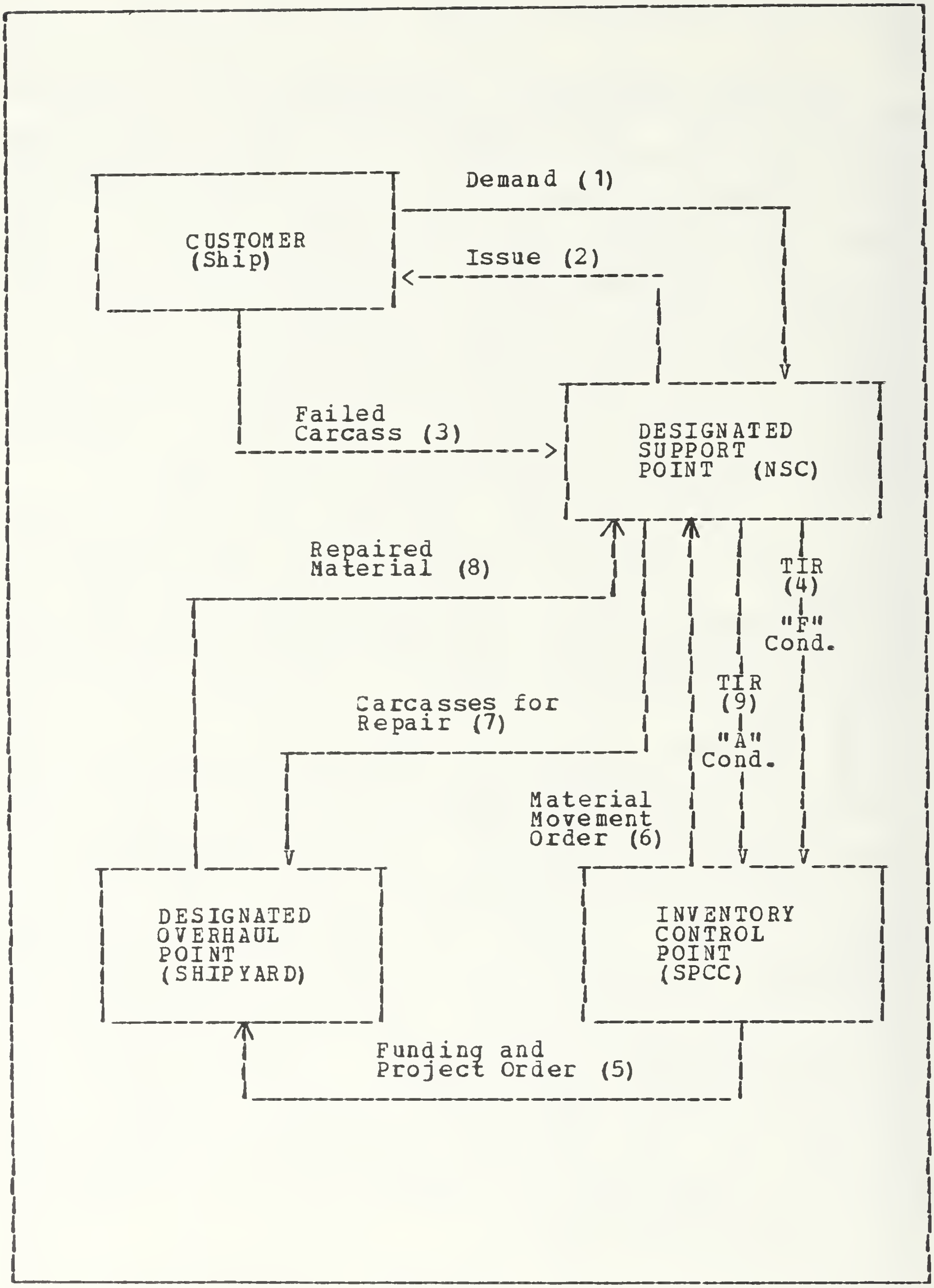

CUSTOMER
(Ship)
Demand (1)
Issue (2)
Failed Carcass (3)
DESIGNATED SUPPORT POINT (NSC)
Repaired Material (8)
TIR (4)
"F" Cond.
Carcasses for Repair (7)
TIR (9)
"A" Cond.
Material Movement Order (6)
DESIGNATED OVERHAUL POINT (SHIPYARD)
INVENTORY CONTROL POINT (SPCC)
Funding and Project Order (5)

Figure 2.1 Non-Aviation Component Repair Process.

B. DETERMINING REPAIR REQUIREMENTS AT SPCC

When a DLR fails in operation it must be returned to the supply system so it can be scheduled for repair. Each operating unit has a copy of the Master Repairable Item List (MRIL). The MRIL contains a listing of all DLRs, the DOP or DSP as well as turn-in procedures and shipping instructions. The failed DLR is normally sent to the NSC nearest the depot having maintenance responsibility for the item. When the carcass is received at the DSP its location and status, such as ready for issue (RFI) or not ready for issue (NRFI) is reported to the IM via Transaction Item Reporting (TIR). Event 4 in Figure 2.1 is the reporting of the receipt of a failed carcass to the IM. Event 9 is the reporting of the receipt of a completed DLR.

The ICP uses the Uniform Inventory Control Point (UICP) computer system to track and monitor the status of all wholesale system assets. The TIR process is the primary means by which the UICP is updated on actions against any asset. This includes: demands, carcass returns, repair inductions to the DOP, repair regenerations, disposals, and receipts of material from procurement or repairs. TIR also calculates and accumulates procurement and repair times. [Ref. 5]

SPCC uses TIR information in four UICP programs to determine the procurement and repair requirements for DLRs. [Ref. 3: p. VII-2]

1. Levels program. Forecasts several key requirements determination elements such as demand, procurement lead time, requisition frequency, and turn around time. Computes wholesale requirements levels such as reorder point, order quantity, and repair level.
2. Supply Demand Review (SDR) program. Compares current inventory assets to requirements (set levels) and makes recommendations to purchase, terminate a

purchase, expedite a purchase, redistribute on-hand assets, or recall material from disposal.

3. Cyclic Repairables Management (B08) program. Compares current inventory assets to the computed repair level to determine repair requirements.
4. Stratification program. Compares forecast requirements with forecast asset levels to project future procurement and repair requirements for budget purposes.

SDR's primary function is to compare assets against requirements over the procurement lead time. If requirements exceeds assets, the IM will receive a recommendation to purchase additional units. The Repair Scheduling (B08) application of UICP compares assets against requirements over the depot turn around time. B08 also uses the urgency of need levels and fleet requirements to recommend repair and redistribution requirements to the IM. Appendix A contains copies of the forms that must be reviewed by the IM prior to workloading the DOP.

B08 divides repair requirements into 4 levels to be used by the DOP to schedule repair work. Repair requirements fall into the following four categories based on urgency of need: [Ref. 3]

1. Level one. High priority backorders and approved special projects.
2. Level two. Other end-use backorders and planned program requirements of a continuing nature.
3. Level three. Backorders for stock and funded planned program requirements due within average depot turn around time.
4. Level four. Wholesale system safety levels. Economic repair quantity.

In addition to the urgency of need, the IM must also consider budget constraints when forecasting repair quantities. The UICP Stratification program uses basic supply data on each item of inventory to calculate the funds required to support the wholesale inventory. The program considers cost of repair, repair turn around time, assets available, and demand. Based on this information the program calculates expected deficiencies and simulates expected procurement and repair requirements for budget preparations. Once the money has been appropriated, the stratification program is rerun to decide what procurements and repairs can be done within the approved budget. It is at this time that the first workload conferences are convened for a given fiscal year.

Semiannually, workload conferences are held to determine and negotiate workload for each organic DOP. Figure 2.2 is a flowchart of the procedures used by SPCC in workload forecasting of quarterly requirements. [Ref. 6]. Normally, attendees at this conferences are program managers for Depot Maintenance, NAVSEA and NAVELEX inventory and maintenance managers, NAVSUP repairables management personnel, SPCC item managers, Fleet Intensified Repairabled Management (FIRM) personnel, NSC personnel and depot personnel from each shipyard [Ref. 3]. Conferences are conducted 75 days prior to the beginning of the workload period. At the conferences, which last one week, representatives of each shipyard and item managers negotiate workload for the upcoming two quarters. Based on capability and capacity, shipyards accept or reject workload requirements. After the conference SPCC prepares quarterly funding documents and repair schedules that will make funds and carcasses available at the beginning of the quarter the work is to be performed.

SPCC uses three types of repair schedules: Cyclic Repair Requirements or "S" schedules, Interim Repair Requirements or "R" schedules and Projected Repair Requirements or "P" schedules. "S" schedules are generated bi-weekly or monthly

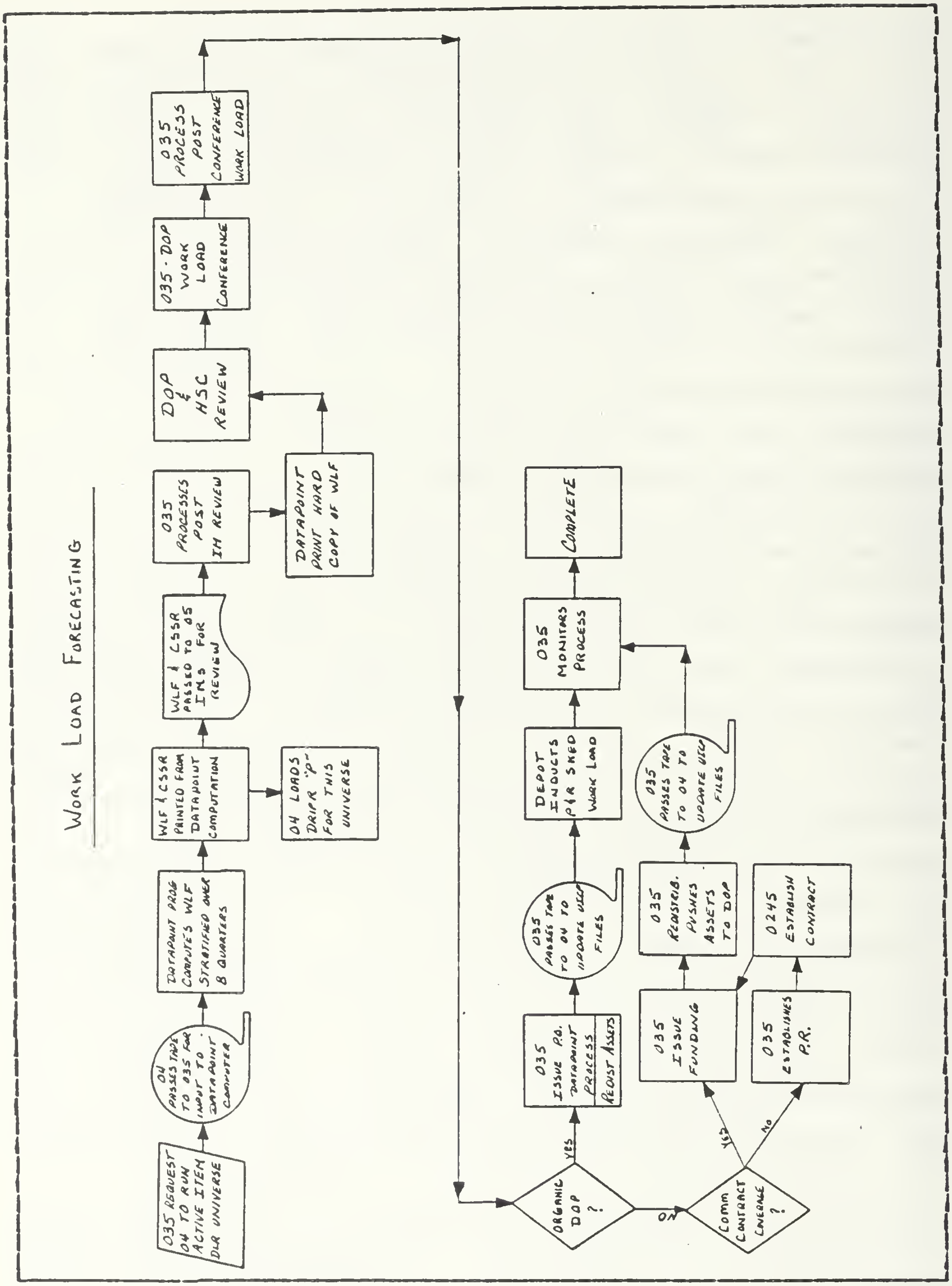

WORK LOAD FORECASTING
035 REQUEST 04 TO RUN ACTIVE ITEM DLR UNIVERSE
04 PASSES TAPE TO 035 FOR INPUT TO DATAPOINT COMPUTER
DATAPOINT PROG COMPUTE'S WLF STRATIFIED OVER 8 QUARTERS
WLF & CSSR PRINTED FROM DATAPOINT COMPUTATION
04 LOADS DRIP "P" FOR THIS UNIVERSE
WLF & CSSR PASSED TO 05 IMs FOR REVIEW
035 PROCESSES POST IM REVIEW
DATAPOINT PRINT HARD COPY OF WLF
DOP & HSC REVIEW
035-DOP WORK LOAD CONFERENCE
035 PROCESS POST CONFERENCE WORK LOAD
ORGANIC DOP ?
YES
NO
035 ISSUE P.O. DATAPOINT PROCESS REDIST ASSETS
035 PASSES TAPE TO 04 TO UPDATE UICP FILES
DEPOT INDUCTS P&R SKED WORK LOAD
035 MONITORS PROCESS
COMPLETE
COMM CONTRACT LINEABLE ?
YES
NO
035 ISSUE FUNDING
035 ESTABLISHES P.R.
035 REDISTRIB. PUSHES ASSETS TO DOP
0245 ESTABLISH CONTRACT
035 PASSES TAPE TO 04 TO UPDATE UICP FILES

Figure 2.2 Flowchart of SPCC's Workload Forecasting Model.

and authorize repairs for low volume items by the DOPs. "R" schedules are for end-use high priority emergency requirements. "P" schedules are generally composed of those items that are scheduled during the workload conferences for planned requirements.

Funds for "P" schedules are open to obligation for 120 days. This is to allow the shipyard to program for DLRs not available at the DSP at the beginning of the quarter but expected to materialize before the end of the quarter. If the carcass is not made available during the quarter the DOP requests that the IM cancel (BSR) the repair requirement and returns the funds if the cancellation is approved.

Project orders are also issued for "S" and "R" schedules to cover any emergent requirements that may occur during the quarter. Figures 2.3, 2.4 and 2.5 are flowcharts of the details of SPCC's B08 cyclic process, processing high priority repair and interim repair requests. Developing a workload must be coordinated between three departments at SPCC. The Planning and Data Systems Group (Code 04) manages and maintains the UICP computer programs and files. The Repairables Support Department (Code 035) manages the repairable program and prepares and issues the funding documents to the DOPs. The IMs are assigned to the Weapons Support Group (Code 05). High priority and interim repair request are initiated by the individual IMs. [Ref. 6]

C. SHIPYARD REPAIRABLES CYCLE

The Shipyard Management Information System (SYMIS) is designed to support the repair and overhaul of ships. It is not designed to manage a repairables program. Although SYMIS is not programmed to provide management information on a repairables program, it does contain all of the data related to the program (ie. cost, job orders, and piece parts requirements). The CNM Repairables Management Manual points out that:

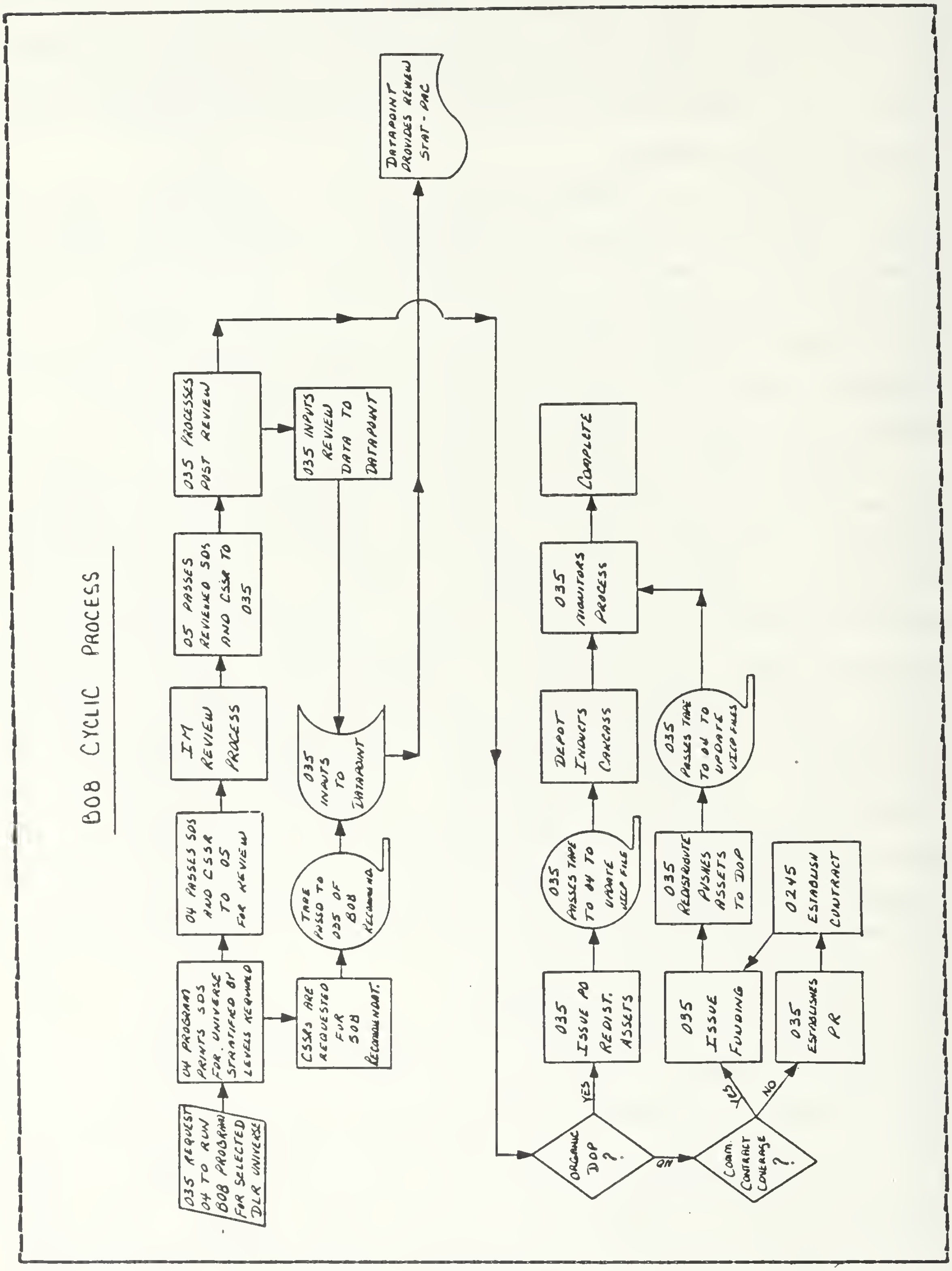

B0B CYCLIC PROCESS
035 REQUEST 04 TO RUN B0B PROGRAM FOR SELECTED DLR UNIVERSE
04 PROGRAM PRINTS SDS FOR UNIVERSE STRATIFIED BY LEVELS REQUIRED
04 PASSES SDS AND CSSR TO 05 FOR REVIEW
IM REVIEW PROCESS
05 PASSES REVIEWED SDS AND CSSR TO 035
035 PROCESSES POST REVIEW
035 INPUTS REVIEW DATA TO DATAPOINT
DATAPOINT PROVIDES REVIEW STAT-PAC
CSSRs ARE REQUESTED FOR 508 RECOMMENDAT.
TAPE PASSED TO 035 OF B08 RECOMMENDA.
035 INPUTS TO DATAPOINT
ORGANIC DOP ?
YES
NO
035 ISSUE PO REDIST. ASSETS
035 PASSES TAPE TO 04 TO UPDATE UICP FILE
DEPOT INDUCTS CARCASS
035 MONITORS PROCESS
COMPLETE
COMM. CONTRACT COVERAGE ?
YES
NO
035 ISSUE FUNDING
035 REDISTRIBUTE PUSHES ASSETS TO DOP
035 PASSES TAPE TO 04 TO UPDATE UICP FILES
035 ESTABLISHES PR
0245 ESTABLISH CONTRACT

Figure 2.3 B08 Cyclic Process.

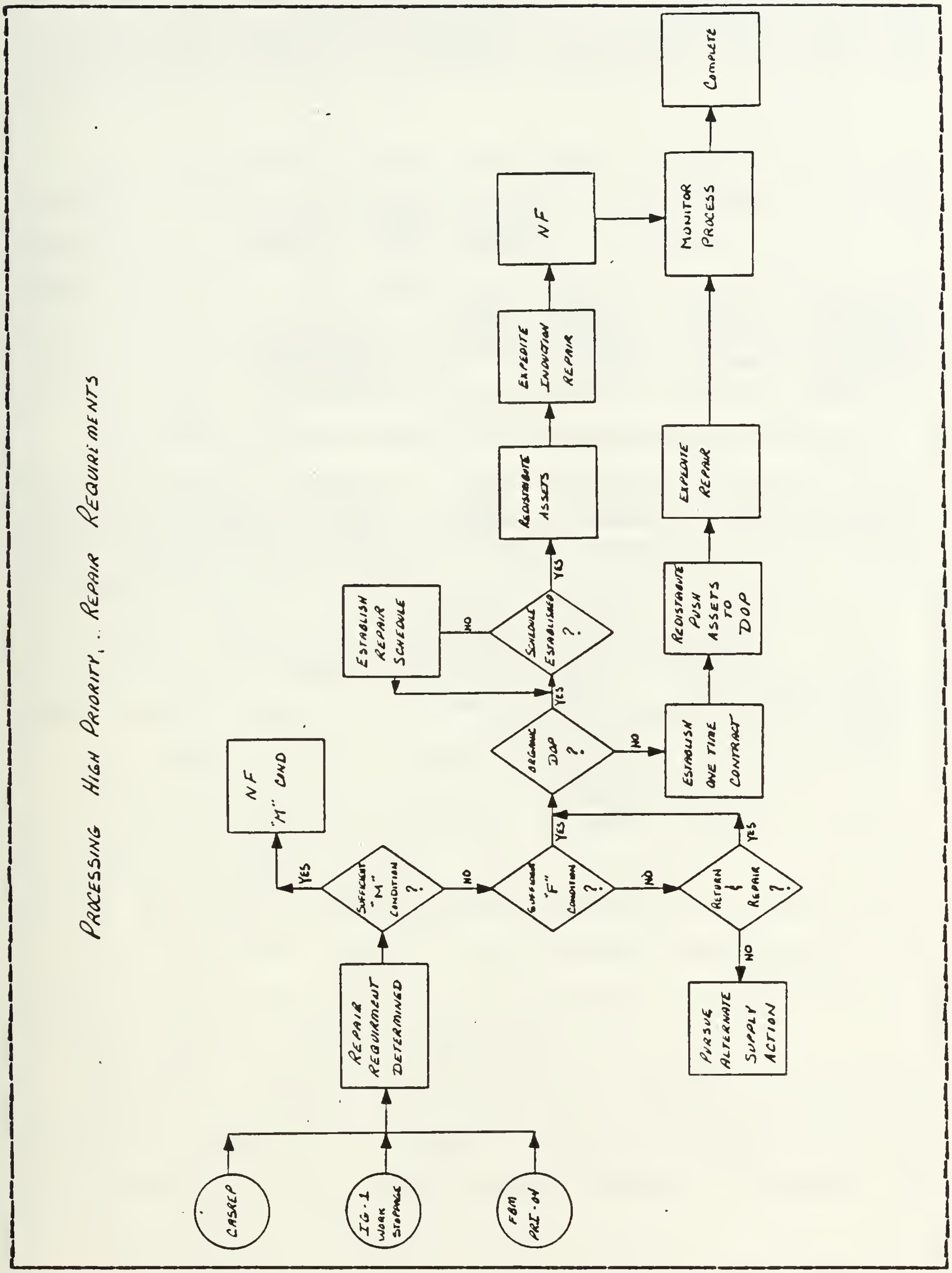

PROCESSING HIGH PRIORITY REPAIR REQUIREMENTS
CASREP
IG-1 WORK STOPPAGE
FBM PRI-ON
REPAIR REQUIREMENT DETERMINED
SUFFICIENT "M" CONDITION ?
YES
NF "M" COND
NO
SUFFICIENT "F" CONDITION ?
YES
NO
RETURN & REPAIR ?
YES
NO
PURSUE ALTERNATE SUPPLY ACTION
ORGANIC DOP ?
YES
NO
ESTABLISH ONE TIME CONTRACT
SCHEDULE ESTABLISHED ?
NO
ESTABLISH REPAIR SCHEDULE
YES
REDISTRIBUTE ASSETS
EXPEDITE INDUCTION REPAIR
NF
REDISTRIBUTE PUSH ASSETS TO DOP
EXPEDITE REPAIR
MONITOR PROCESS
COMPLETE

Figure 2.4   Processing High Priority Repair Requirements.

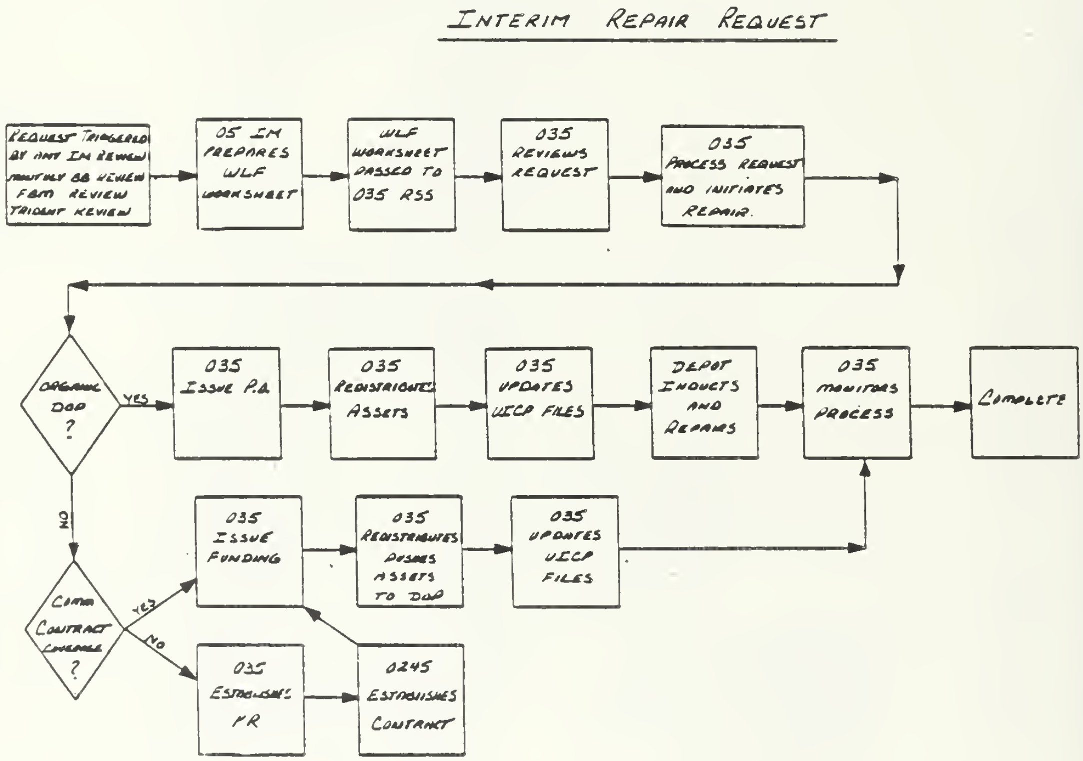

INTERIM REPAIR REQUEST
REQUEST TRIGGERED BY ANY IM REVIEW MONTHLY BB REVIEW FBM REVIEW TRIDENT REVIEW
05 IM PREPARES WLF WORKSHEET
WLF WORKSHEET PASSED TO 035 RSS
035 REVIEWS REQUEST
035 PROCESS REQUEST AND INITIATES REPAIR.
ORGANIC DOD ?
YES
NO
035 ISSUE P.A
035 REDISTRIBUTES ASSETS
035 UPDATES UICP FILES
DEPOT INDUCTS AND REPAIRS
035 MONITORS PROCESS
COMPLETE
COMM CONTRACT COVERAGE ?
YES
NO
035 ISSUE FUNDING
035 REDISTRIBUTES PUSHES ASSETS TO DOD
035 UPDATES UICP FILES
035 ESTABLISHES PR
0245 ESTABLISHES CONTRACT

Figure 2.5 Processing Interim Repair Request.

> Changes are therefore necessary to improve the standard SYMIS and provide a greater capability for managing repairables programs within the shipyard. [Ref. 3: p. XI-16]

Most shipyards process repairables information manually. However, Long Beach Naval Shipyard has developed and implemented an Automated Repairables Management Information System (ARMIS)[1] ARMIS is a relational data based computer system used in conjunction with SYMIS to provide management information, scheduling and automatically prepare many of the forms and reports that were formerly done manually.

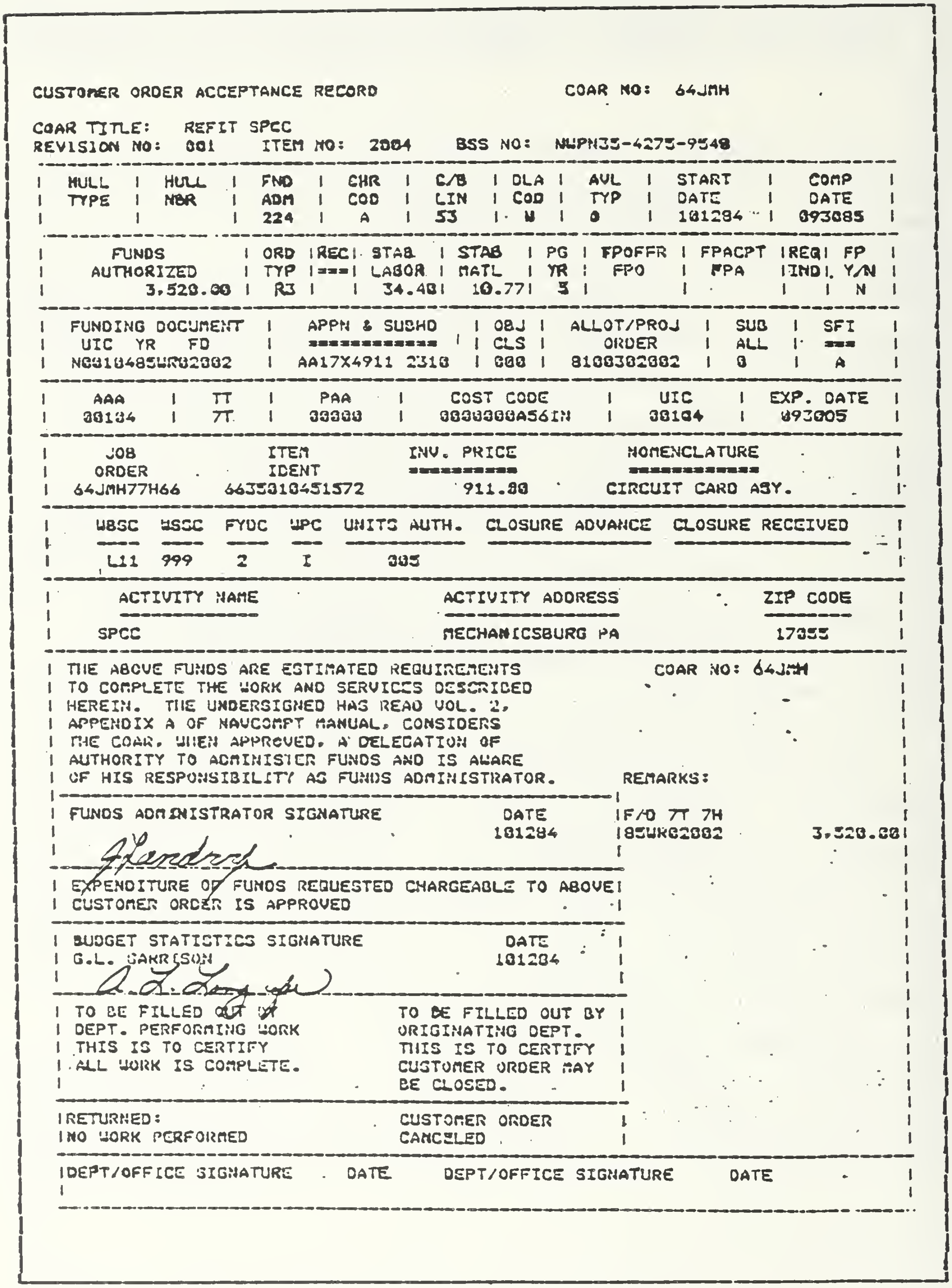
Other initiatives that have improved repairables management include the Customer Order Documentation System (CODS) which permits electronic transfer of funds and has automatically prepares the Customer Order Acceptance Record (COAR). A COAR is basically the contract whereby the shipyard agrees to repair a component(s) for a particular price. It contains basic information about the repairs, source of funds, amount, what is to be repaired and quantity. Figure 2.6 is a copy of a COAR generated by CODS.

The recent implementation of a Material Management (MM) function of SYMIS has increased visibility and control of shipyard inventory receipt and processing. This system tracks the status of all material ordered to support repairs on both ships and DLRs. The Material Requirements (MR) portion has been modified to maintain a history of all material used to repair a specific DLR.

The Fleet Material Support Office (FMSO) has recently developed a program, (UR22), for automating the repair induction process. To date, the UR22 program has been incorporated in the Stock Point Uniform Automated Data

---

[1] Detailed information on ARMIS is contained in Chapter III.



CUSTOMER ORDER ACCEPTANCE RECORD COAR NO: 64JMH

COAR TITLE: REFIT SPCC
REVISION NO: 001 ITEM NO: 2004 BSS NO: NWPN35-4275-9548

HULL TYPE	HULL NBR	FND ADM	CHR COD	C/B LIN	DLA COD	AVL TYP	START DATE	COMP DATE
		224	A	53	N	0	101284	093085

FUNDS AUTHORIZED	ORD TYP	REC ===	STAB LABOR	STAB MATL	PG YR	FPOFFR FPO	FPACPT FPA	REQ IND	FP Y/N
3,520.00	R3		34.40	10.77	5				N

FUNDING DOCUMENT UIC YR FD	APPN & SUBHD ============	OBJ CLS	ALLOT/PROJ ORDER	SUB ALL	SFI ===
N0010485WR02002	AA17X4911 2310	000	8100302002	0	A

AAA	TT	PAA	COST CODE	UIC	EXP. DATE
00134	7T	00000	0000000A56IN	00104	093005

JOB ORDER	ITEM IDENT	INV. PRICE ==========	NOMENCLATURE ============
64JMH77H66	6635010451572	911.00	CIRCUIT CARD ASY.

WBSC	WSSC	FYDC	WPC	UNITS AUTH.	CLOSURE ADVANCE	CLOSURE RECEIVED
L11	999	2	I	005		

ACTIVITY NAME	ACTIVITY ADDRESS	ZIP CODE
SPCC	MECHANICSBURG PA	17055

THE ABOVE FUNDS ARE ESTIMATED REQUIREMENTS TO COMPLETE THE WORK AND SERVICES DESCRIBED HEREIN. THE UNDERSIGNED HAS READ VOL. 2, APPENDIX A OF NAVCOMPT MANUAL, CONSIDERS THE COAR, WHEN APPROVED, A DELEGATION OF AUTHORITY TO ADMINISTER FUNDS AND IS AWARE OF HIS RESPONSIBILITY AS FUNDS ADMINISTRATOR.

COAR NO: 64JMH

REMARKS:
F/O 7T 7H
85WR02002 3,520.00

FUNDS ADMINISTRATOR SIGNATURE DATE
101284
J. Landry

EXPENDITURE OF FUNDS REQUESTED CHARGEABLE TO ABOVE CUSTOMER ORDER IS APPROVED

BUDGET STATISTICS SIGNATURE DATE
G.L. GARRISON 101284

TO BE FILLED OUT BY DEPT. PERFORMING WORK
THIS IS TO CERTIFY ALL WORK IS COMPLETE.

TO BE FILLED OUT BY ORIGINATING DEPT.
THIS IS TO CERTIFY CUSTOMER ORDER MAY BE CLOSED.

RETURNED:
NO WORK PERFORMED

CUSTOMER ORDER CANCELED

DEPT/OFFICE SIGNATURE DATE DEPT/OFFICE SIGNATURE DATE

Figure 2.6 Automated Customer Order Acceptance Record.

Processing System (UADPS-SP) at one DSP. This program allows the DOP to make inductions using a terminal located at the shipyard. [Ref. 7]

D. MAJOR SHIPYARD FUNCTIONS

The repair of DLRs within the shipyard is composed of six major functions. These are Production Controller (PC), Funds Administration Planning and Estimating (P&E), Scheduling, Induction, and Actual Repair.

1. Production Control

At the beginning of each quarter SPCC prepares the funding document and repair schedule. This is normally put in the mail and sent to the production controller at the shipyard. For emergency requirements naval messages are used. Upon receipt of the funding document, the PC will verify the quantity authorized for repair and ensure the funds match the repair quantity. He also verifies that the shipyard has the capability and capacity to repair the item. Any discrepancies are usually resolved by telephone with the item manager.

2. Funds Administration

The funding document and repair schedules are then sent to the comptroller where a Customer Order Acceptance Record (COAR) will be established in SYMIS. This allows repair costs to be charged against the right job when the actual repair starts. Normally one COAR is established per funding document even though it may contain a hundred or more different line items. This practice also allows the financial administrator (normally the PC) to shift funds between line items. When one line item's repair cost exceeds the quoted repair price, funds from another item that is under cost can be used to cover the item that is over cost.

When the COAR has been established in SYMIS the PC can then prepare the log sheet and work estimate sheets

(WES). Figures 2.7 and 2.8 are samples of a log sheet and work estimate sheet. Log sheets are used as a management tool by the PC to keep pertinent data of the line item on each project order including NSN, BSS number, nomenclature, job order number, authorized quantity, repair costs, estimated repair hours, date job was issued and date completed. It should be noted that log sheets are not common to all shipyards. In addition, only ARMIS can automatically generate a log sheet.

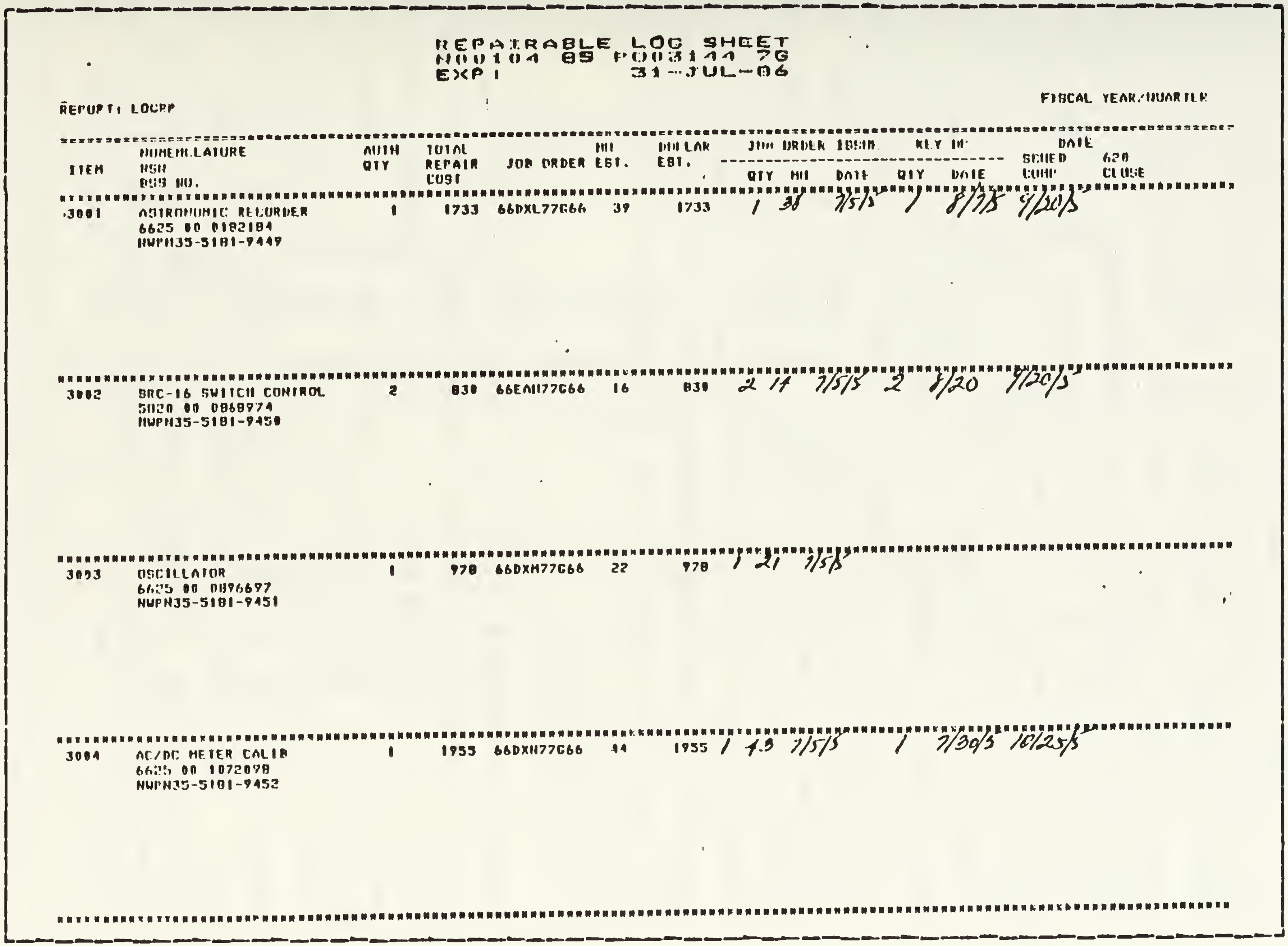
Methods of retaining information on what is being repaired on each funding document vary between shipyards and production controllers within shipyards. WESs are internal planning department sheets which contain pertinent information of what will be repaired. WES sheets are used by P&E to write job orders. One WES must be prepared for each line item on the project order. Usually, WES sheets are prepared manually by the PC, only ARMIS has automated the preparation of WES.

3. Planning and Estimating

P&E will prepare a work control document (WDC) for each WES. The work control document is a detailed outline of what work must be accomplished and hours authorized for each shop and work centers. The WCD also contains any technical documentation applicable to the repairs. Figure 2.9 is a sample WCD.

For items which have a repair history P&E personnel have generated standard Job Material Lists (JMLs). JMLs are in-house requisitions sent to the supply department for known piece part requirements.

Some shipyards use Wang computers to maintain a list of piece parts required to repair DLRs. The Wang computers are also used to process requisitions for piece parts into the SYMIS. However, if P&E is unfamiliar with the line item he must research what piece parts are required and hand prepare JMLs.



REPAIRABLE LOG SHEET
N00104 85 P003144 7G
EXP I 31-JUL-06

REPORT: LOCRP

FISCAL YEAR/QUARTER

ITEM	NOMENCLATURE NSN BSS NO.	AUTH QTY	TOTAL REPAIR COST	JOB ORDER	MH EST.	DOLLAR EST.	JOB ORDER ISSUE			KEY IN		DATE	
							QTY	MH	DATE	QTY	DATE	SCHED COMP	620 CLOSE
3001	ASTRONOMIC RECORDER 6625 00 0182184 NWPN35-5181-9449	1	1733	66DXL77G66	39	1733	1	38	7/5/5	1	8/7/5	9/20/5	
3002	BRC-16 SWITCH CONTROL 5820 00 0868974 NWPN35-5181-9450	2	830	66EAN77G66	16	830	2	14	7/5/5	2	8/20	9/20/5	
3003	OSCILLATOR 6625 00 0896697 NWPN35-5181-9451	1	978	66DXM77G66	22	978	1	21	7/5/5				
3004	AC/DC METER CALIB 6625 00 1072098 NWPN35-5181-9452	1	1955	66DXN77G66	44	1955	1	43	7/5/5	1	7/30/5	10/25/5	

Figure 2.7 Sample Log Sheet.

4. Scheduling

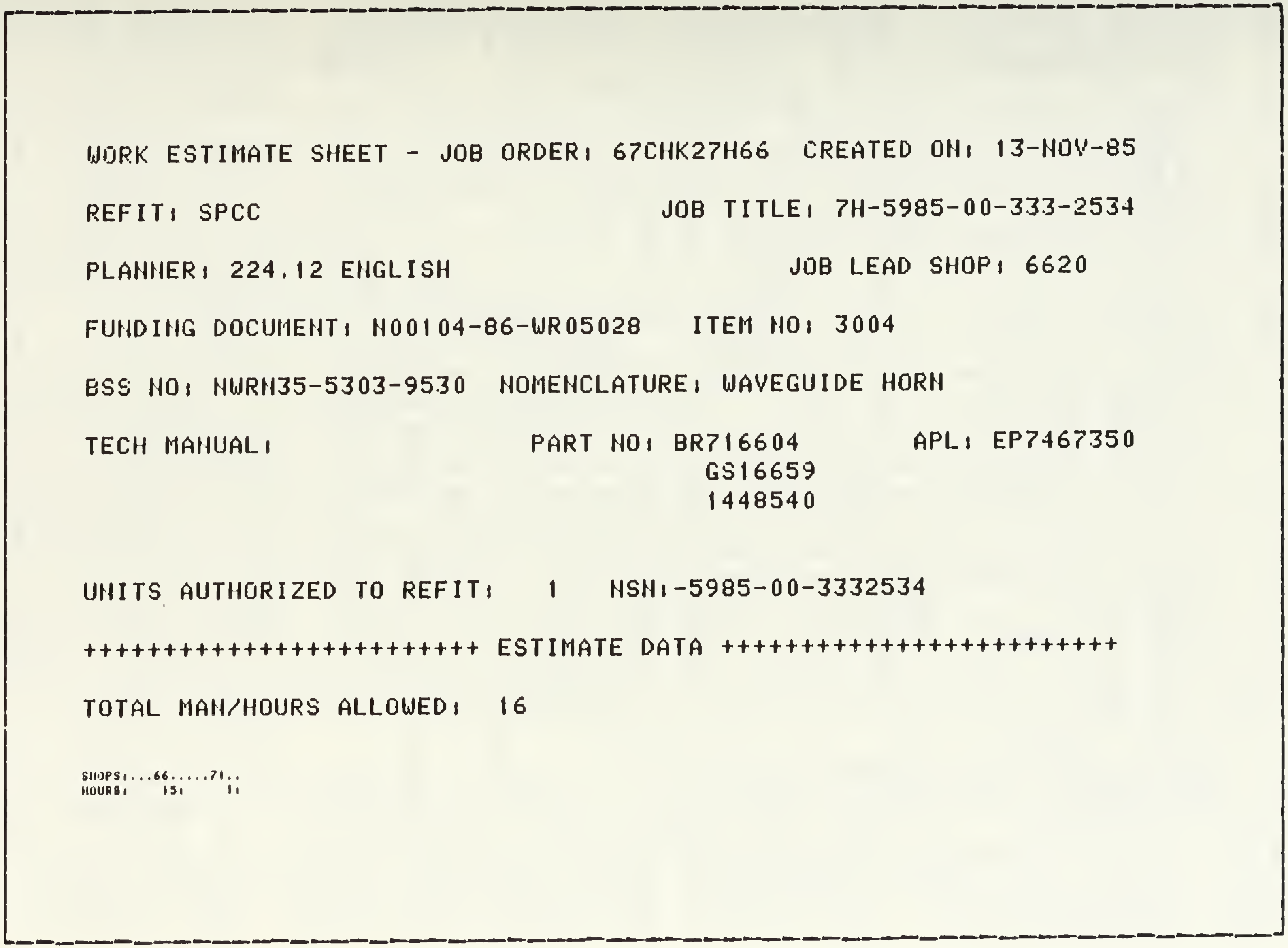
After the WCD and associated JMLs have been prepared P&E forwards the WCD to scheduling. Scheduling reviews the current workload for the affected shops and schedules the repair of the carcass. The WCD is then sent to local printing for reproduction and distribution. Copies of the WCD are also sent to keypunch to be input into SYMIS. When the WCD information has been entered into SYMIS the job is open to repair charges by the authorized shops. The WCD is passed to the applicable shop planners who monitor the actual repair process. The shop planner establishes key operation for each job order in SYMIS. Key operation are those activities that must take place to repair the carcasses. Examples of key operations are open and inspects, repair and test. The shop planner authorizes the number of hours for each work center to complete each key operation. When this information has been put into SYMIS the shop can induct up to the authorized quantity and commence repair.

5. Induction

To induct a carcass, most shipyards prepare a JML which is forwarded to the DSP holding the failed carcass. In the future, they will use the automated induction program (UR22) developed by FMSO . The UR22 program gives the person making the induction visibility of all "F" condition[2] assets at the DSP and automatically generates an induction notice via CRT input at the DOP. The carcass is then shipped directly to the applicable repair shop in the shipyard. This program also generates ZUC and ZUB cards. The ZUC functions as a proof of receipt by the shipyard and is signed when the material is received. Once signed, the card is retained by the DSP. The ZUB card remains with the

---

[2] "F" condition code refers to a failed DLR that has been returned to the DSP for repairs.



```
WORK ESTIMATE SHEET - JOB ORDER: 67CHK27H66  CREATED ON: 13-NOV-85

REFIT: SPCC                               JOB TITLE: 7H-5985-00-333-2534

PLANNER: 224.12 ENGLISH                          JOB LEAD SHOP: 6620

FUNDING DOCUMENT: N00104-86-WR05028   ITEM NO: 3004

BSS NO: NWRN35-5303-9530  NOMENCLATURE: WAVEGUIDE HORN

TECH MANUAL:                 PART NO: BR716604       APL: EP7467350
                                         GS16659
                                         1448540


UNITS AUTHORIZED TO REFIT:   1   NSN:-5985-00-3332534

+++++++++++++++++++++++++ ESTIMATE DATA +++++++++++++++++++++++++

TOTAL MAN/HOURS ALLOWED:  16

SHOPS:...66.....71..
HOURS:    15:     1:
```

Figure 2.8   Sample Work Estimate Sheet.

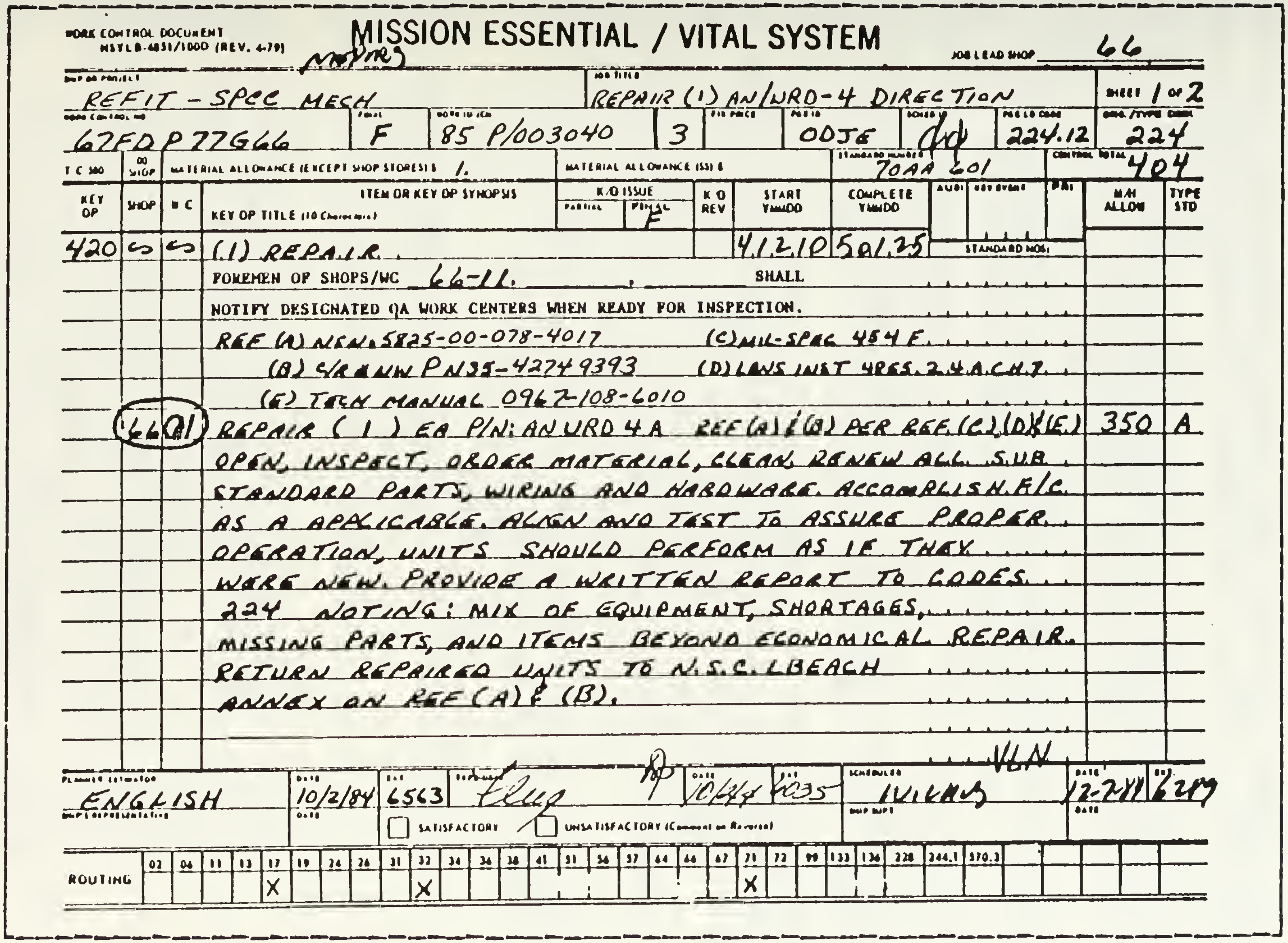
carcass and is returned to the DSP when repairs have been completed. [Ref. 8]

Several shipyards have prepared local induction sheets that are passed to the DSP to induct carcasses. The stock point then pulls the carcass and forwards it to the DOP. At this point the DSP reports the change in condition code from "F" to "M" via TIR to the ICP. The signed ZUC card is used for TIR. "M" condition means the carcass is in repair.

6. Repair In Process

When the shop receives the carcass it is inspected to determine if it can be repaired. This is only a cursory inspection to see if all major components are present. If the carcass can not be repaired economically the item is removed from "M" condition and placed in "H" condition (disposal) and returned to the DSP and another carcass is inducted. If the disposal action is approved by the IM or on site SPCC representative, the usable portions of the carcass are cannibalized and retained by the shipyard for use in later repairs. For carcass with missing subassemblies a Defective Material Report (DMR) is prepared and forwarded to the IM. If the turn-in activity is known, the IM will request the missing parts be sent to the shipyard or the turn-in activity will be charged the price of a new replacement for the failed carcass vice only the repair price.

During the repair process the mechanic may identify additional repair parts. If the lead time on these parts are expected to exceed 30 days the item should be placed in "G" condition (awaiting parts). By placing a carcass in "G" condition the IM is notified via TIR that repairs have stopped due to a lack of repair parts. The DOP is required to list the required parts and associated requisition numbers on the monthly refit reports. To accomplish this



WORK CONTROL DOCUMENT
NSTLB-4851/1000 (REV. 4-79)

MISSION ESSENTIAL / VITAL SYSTEM

JOB LEAD SHOP 66

SHIP OR PROJECT REFIT - SPCC MECH

JOB TITLE REPAIR (1) AN/URD-4 DIRECTION

SHEET 1 OF 2

67FDP77G66 | F | 85 P/003040 | 3 | ODJE | 224.12 | 224

T C 300 | 00 SHOP | MATERIAL ALLOWANCE (EXCEPT SHOP STORES) $ 1. | MATERIAL ALLOWANCE (SS) $ | STANDARD NUMBER 70AA 601 | CONTROL TOTAL 404

KEY OP	SHOP	W C	ITEM OR KEY OP SYNOPSIS KEY OP TITLE (10 Characters)	K/O ISSUE PARTIAL	K/O ISSUE FINAL	K O REV	START YMMDD	COMPLETE YMMDD	M/H ALLOW	TYPE STD
420	66	66	(1) REPAIR.		F		41210	50125		

FOREMEN OF SHOPS/WC 66-11. , SHALL

NOTIFY DESIGNATED QA WORK CENTERS WHEN READY FOR INSPECTION.

REF (A) NSN. 5825-00-078-4017 (C) MIL-SPEC 454 F.

(B) S/RANW PN35-42749393 (D) LANS INST 4855.24A CH.7.

(E) TECH MANUAL 0967-108-6010

66 01 REPAIR (1) EA P/N: AN URD 4A REF (A) & (B) PER REF (C) (D) & (E) 350 A

OPEN, INSPECT, ORDER MATERIAL, CLEAN, RENEW ALL SUB

STANDARD PARTS, WIRING AND HARDWARE. ACCOMPLISH E/C

AS A APPLICABLE. ALIGN AND TEST TO ASSURE PROPER

OPERATION, UNITS SHOULD PERFORM AS IF THEY

WERE NEW. PROVIDE A WRITTEN REPORT TO CODES

224 NOTING: MIX OF EQUIPMENT, SHORTAGES,

MISSING PARTS, AND ITEMS BEYOND ECONOMICAL REPAIR.

RETURN REPAIRED UNITS TO N.S.C. LBEACH

ANNEX AN REF (A) & (B).

VLN

PLANNER ESTIMATOR ENGLISH | DATE 10/2/84 | EXT 6563 | DATE 10/2/84 | EXT 6035 | SCHEDULER | DATE 12-2-84 | EXT 6299

SHIP'S REPRESENTATIVE | DATE | ☐ SATISFACTORY ☐ UNSATISFACTORY (Comment on Reverse) | SHIP SUPT | DATE

ROUTING	02	04	11	13	17	19	24	26	31	32	34	36	38	41	51	56	57	64	66	67	71	72	99	133	136	228	244.1	370.3
					X					X											X							

Figure 2.9 Sample Work Control Document.

the shipyard will notify the DSP to place the carcass in "G" condition. While in "G" condition the RTAT is interrupted and the carcass put in custody storage. Custody storage may or may not be at the DSP depending on the complexity of the equipment as well as local agreements made between the DOP and DSP. When the parts arrive at the shipyard, the carcass is returned to "M" condition and rescheduled for repair.

When the repair has been completed the DLR is returned to the DSP and reported in "A" condition via TIR (ZUB card). The shipyard attaches a documentation tag to each completed DLR identifying the DOP, the mechanic who repaired the item and the date repairs were completed. This tag remains with the item until it is placed in service by the end user. Preservation of the DLR is accomplished by the DOP prior to returning the DLR to the DSP. With very few exceptions the DSP will package the DLR. Most shipyards provide separate funding to the DSP for this service. Before the DLR can be issued it must be stowed at the DSP and its location reported via a ZUD transaction. This TIR notifies the IM the DLR is in RFI condition.

E. DOP REPORTING REQUIREMENTS.

In addition to the information reported to the ICP concerning RTAT, the DOP is required to submit monthly refit status reports containing the following information. [Ref. 3: p. XII-4,5].

1 Repairable Surveys: The number of units beyond economic repair. This is entered in SPCC's Repair History File and is used in computing wearout and survival rates. Intermediate Maintenance Activities (IMA) surveys obtained from the 3M system are not included in the computation of survival rate at the depot, but are an additional element in the computation of the wearout rate. Items condemned or surveyed by the DOP will be transferred from "M" to "H" condition and expended from "H". Expenditures from "H" will be used to compute wearout and survival rates.

2 Repair Completions: The number of units that were completely repaired during the time period, by NSN and by DOP (transfers from "M" to "A" condition). This information is entered in the Repair History File.

3 DOP NIF Rates: Navy Industrial Fund rates for the cost-per-hour work performed by a DOP. These are stabilized rates and normally do not change during the fiscal year.

4 DOP Workload Standard (NORM): Organic DOP repair time plus administrative time required to complete repair of an item. This information is maintained by the DOP and used in conjunction with the applicable NIF rate to determine the DOP repair price.

5 DOP Capability Code: This code reflects current, actual repair capability or noncapability at a specific DOP and provides noncapability by reason. It is used in the BC8 probe and MRIL assignments.

6 DOP prime shop: The DOP prime shop area for each specific component is listed.

7 Type Repair Directive Code: The type of repair directive is identified: NWS = Scheduled B08 requirement; NWP = Projected or workload requirement; NWR = Interim requirement.

8 Bill Of Essential Support Parts: Repair part requirements (by NSN) are identified for all repairables for which that repair facility is the assigned DOP. The probability factor (expressed as a percentage) that particular repair part will be required in the repair of a single unit of the repairable is also listed.

9 Repair Price: These prices are computed from observed repair actions for a specific NSN and dated to show the date the item repair price was negotiated.

10 Repair Cost: Includes direct labor cost to repair, material cost to repair, and other costs such as overhead are presented. This provides visibility of price variances for comparison among commercial, interservice, and organic facilities for like items. Manhours to do repair are also listed.

11 Beyond Economical Repair: Identify items for which repair costs will be excessive (greater than 75 percent of current procurement cost).

12 Current Funds Received: The dollar value of all repair schedules received and accepted at the DOP is listed.

13 Current Funds Scheduled: The dollar value of all schedules accepted for which there has been no induction (outstanding requirements) is listed.

14 Current Funds in Process: The dollar value of repair schedules that have been inducted for repair but are not yet complete is listed

15 Funds Obligated or Expended to Date: The dollar value of all schedules that have been inducted and/or completed during the fiscal year is listed.

16 Other Reporting Requirements: Unique data requirement emanating from special procedures for processing repairable material for Security Assistance Program (SAP), training equipment, battery jars, etc. is listed.

F. RTAT PERFORMANCE

CNM defines repair turn around time as:

> the time from generation of a repair directive to the date repair is completed, indicated by a TIR transferring the item from "M" to "A" condition. [Ref. 3: p. XII-3]

To maintain visibility and management control over DLRs in the repair process CNM requires that the SPCC IM maintain RTAT by item and family group. Actual RTATs are to be compared with established performance goals. To enable the ICP to measure RTAT the depot is required to report the various segments constituting RTAT. [Ref. 3: p XII-3]. Figure 2.10 is a graphic portrayal of the RTAT segments and performance goals. The definitions of the segments are: [Ref. 3: p. XIII-9].

1 DOP Acceptance: Time from ICP forwarding of a repair schedule and funding to a DOP to the date of acceptance by the DOP.

2 DOP Carcass Request: Time from DOP acceptance of repair schedule to the date of request for carcasses from the DSP.

3 DOP Material Receipt: Time for DOP request for carcasses until DOP receipt of material.

4 DOP Induction: Time from DOP receipt of carcasses until repair start date ("M" condition TIR).

5 DOP Repair in Process: Time in "M" condition (exclusive of "G" condition time). This time will be measured for each repair action via TIRs and computed as a periodic average for NSN, COG and DOP.

6 Awaiting Parts: Time in "G" condition as measured by TIRs. Time will be computed for each repair action and used in developing a DOP and system average AWP time and in highlighting excessive AWP situations as they occur.

7 RFI Receipt Time: Time from completion of a repair until the item is reported in "A" condition via TIR. This includes time in preservation and packaging after the repair has been completed. This time is measured for each repair action and used to compute the average DOP time to make repairables ready for shipment after repair.

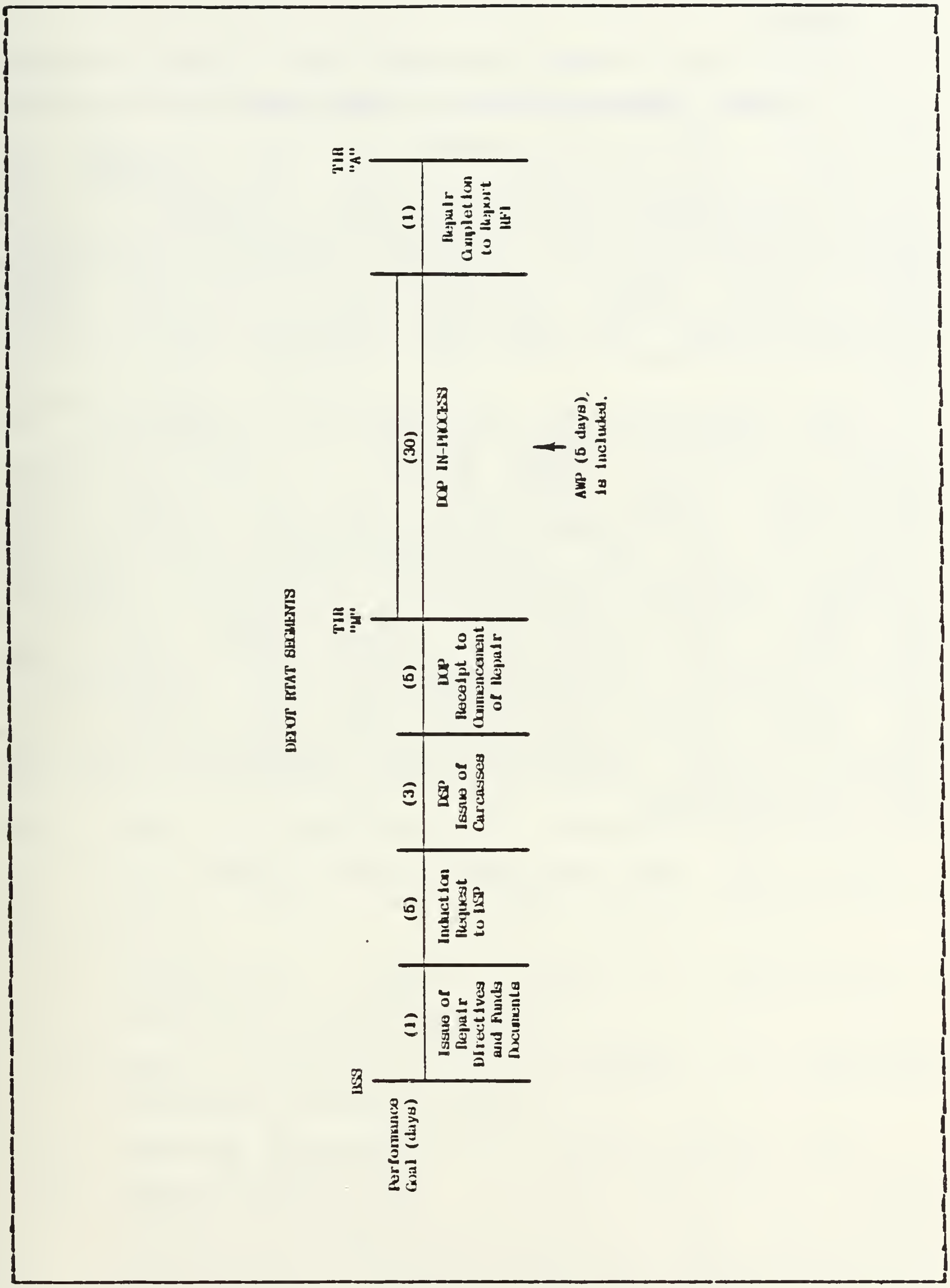

DEPOT RTAT SEGMENTS
Performance Goal (days)
BSS
(1)
Issue of Repair Directives and Funds Documents
(5)
Induction Request to DSP
(3)
DSP Issue of Carcasses
(5)
DOP Receipt to Commencement of Repair
TIR "M"
(30)
DOP IN-PROCESS
AWP (5 days), is included.
(1)
Repair Completion to Report RFI
TIR "A"

Figure 2.10 Depot RTAT Segments.

G. SUMMARY

This chapter provides the reader with a general overview of the repair cycle as well as a feel for the complexities involved in effectively managing the repair of DLRs. It provides a brief description of how SPCC determines DLR repair requirements and workloads the shipyards. A more detailed description is provided of the steps and procedures each shipyard takes to repair DLRs. It also details performance goals and reporting requirements set forth by CNM.

Some simplifications were made and the chapter is not intended to be a complete picture of how each shipyard and/or SPCC actually operates. Each step in the repair process is a complicated interface of various activities, computer systems, and individuals. Each is dependent upon the other to effectively manage repairables. In such a complicated environment there is ample opportunity for problems to develop. The next chapter will look at each step in the repair process and identify problems that tend to increase RTAT and hinder effective management at both SPCC and the shipyards.

III. ANALYSIS OF THE REPAIRABLES CYCLE

A. GENERAL

As outlined in Chapter II, the repairables cycle is a complicated system with numerous interfaces between various organizations, computer systems and people. To efficiently move a failed carcass through the repairables cycle these organizations, computer systems and people must coordinate their actions and ideas.

This chapter will address current practices and procedures which tend to increase repair turn around time and will recommend actions which may be taken to reduce RTAT. Many of the recommendations are based on the author's personal experience as the Repairables Management Officer at Long Beach Naval Shipyard from March 1982 to May 1984. Additionally, areas in which individual shipyards have taken the initiative to implement policies and procedures that have reduced RTAT will also be explored. Prototype improvements have been developed in both the organization and automation areas at individual DOPs. However, little has been done at the system level to coordinate these improvements at all organic DOPs. The specific areas which will be discussed are:

1. Institutional issues, related to the problems in measuring DOP performance;
2. Depot organization as it pertains to repairables management and DLR repairs;
3. Workload forecasting as it affects organic DOPs.
4. Administrative time, the time required to process funding documents at the DOP; this time includes preparation of all documentation necessary to induct a carcass for repair as well as the induction time.

5. Repair In Process Time (RIPT), the time from receipt of the carcass in the repair shop until repair is completed and turned over to the DSP in "A" condition.
6. Preservation, packaging and storage time, is the time required for the DSP to P&P, and store the DLR in RFI condition.
7. Automated Repairables Management Information System (ARMIS)

Several Naval Audit reports conducted in the early 1980's point out the deficiencies in the repairables management functions at shipyards.

> NAVSHIPYD does not have a Repairables Management Organization with centralized authority and responsibility. As a result, repairables processing is fragmented and lacks overall coordination and direction [Ref. 1: p. 3].

The report goes on to say this problem stems from:

1 Lack of dedicated personnel;

2 Lack of recognition/support for repairables within the shipyard;

3 Lack of precisely defined departmental functions and responsibility regarding repairables; and

4 Lack of interfaces between shops, shop planners, progressmen and expediters.

Another report cited a similar problem.

> NAVSHIPYD does not provide as intensive support for the repair of 2F/2S cognizance and secondary items as contemplated by governing directives. ... its production shops are dedicated to overhaul of ships on the waterfront, and repairables work is accepted only as shop schedules permit [Ref. 2: p. 2].

These reports were based on specific problems at two different DOPs. However, the problems cited are common to most of the shipyards visited. The problems addressed in the audit reports as well as several problems that were not mentioned will be examined in this chapter.

B. INSTITUTIONAL ISSUES

Before examining the problems with the repair cycle, it is important to define segmented RTAT responsibilities and look at the criteria currently in use to measure DOP performance. These are important because they affect the policies and procedures adopted at the DOPs.

SPCC measures DOP performance in two ways, (1) RTAT and (2) workload backlog [Ref. 9]

1. RTAT

SPCC uses TIR information to compute RTAT by National Stock Number (NSN), Cognizance Symbol (cog), and Depot. SPCC defines DOP repair turn around time as the time from when the carcass and funding are available to the time the carcass is reported in ready for issue (RFI) condition [Ref. 9]. This definition differs from CNM's definition presented at the end of Chapter II, which includes the induction time but does not include preservation, packaging and storage time. SPCC's definition includes the additional time the item is in preservation and packaging (P&P) as well as the time the DSP takes to stow the item and TIR it as RFI. With the exception of one shipyard visited, P&P and storage are accomplished after the item is turned over to the DSP in "A" condition [Ref. 10].

Both SPCC's and CNM's definitions include the time it takes the DSP to deliver the carcass to the DOP once the request for induction has been made. It is the DSP's responsibility, not the DOPs, to move the carcasses to the DOP in a timely manner.

The shipyards have a problem with both of the above definitions because both definitions contain times over which the DOP has no control.

When discussing what can be done to reduce RTAT it is important to specify who has responsibility for each segment of the cycle. DOP's should not be measured on segments of RTAT over which they have no control. NAVSUP should provide definitive guidance on who has responsibility for each segment of the repair cycle as well as realistic times for each segment to be accomplished.

RTAT is computed exclusive of "G" condition time (awaiting parts). Current regulations require the DOP to package a DLR and return it to the DSP when a item is placed in "G" condition. Additionally, the DOP should cancel the requisitions and have the DSP reorder the required parts. When the parts are received, the DLR and the repair parts are returned to the DOP to complete repairs.

For the larger DLRs it is not cost effective to gather up all the sub-assemblies and component parts that have been sent to various shops and workcenters for repair. Consequently, most DOPs do not use "G" condition for these larger items. At one DOP visited, "G" condition was not used at all and at another only one DLR was in "G" condition. When "G" condition is not used RTAT suffers. SPCC is also unaware that repair has stopped and can not expedite the required repair parts.

To encourage the use of "G" condition, NAVSUP should authorize local agreements between the DOP and DSP to allow larger DLRs to remain in the custody of the DOP pending receipt of the parts. The policy of canceling the DOP's requisitions and the DSP reordering the parts should be rescinded, particularly in view of the increasing procurement lead times. The DOPs will have to assume responsibility for notifying the DSP when a DLR has been placed in "G" condition as well as when repairs have restarted.

2. Workload Backlog

SPCC uses the workload backlog statistics to measure how much work the DOP has on hand. Backlog is the total number of carcasses scheduled minus those completed and or canceled (BSR). Based on the last six quarters data, SPCC computes the average number of units completed each quarter and compares that figure to the average number of units available for induction. If the the average number completed each quarter exceeds the average number of units scheduled, the DOP is said to be working down its backlog.

Figure 3.1 is a sample of the form used to compute backlog. In this example, the DOPs average units completed the last two quarters is 118 percent of the average units available for induction. However, the report shows the current backlog will still support one and one half quarters worth of work. Table I is a summary of the backlogs that SPCC has calculated for 7H cog for each of the DOPs visited in this study, based on the last six quarters' workload.

TABLE I

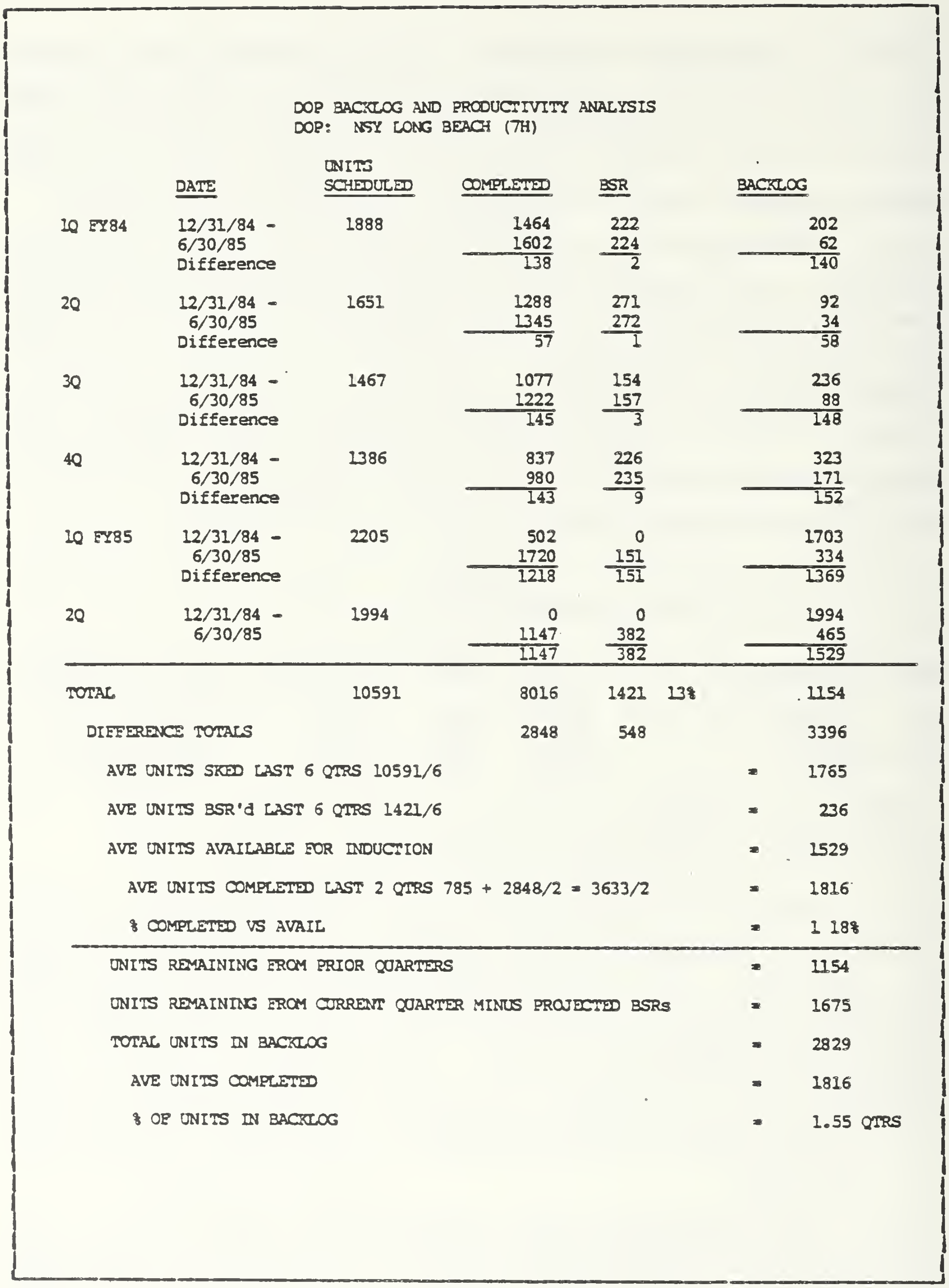
7H WORKLOAD BACKLOG IN UNITS

DOP	SCHEDULED	COMP.	BSR*	BACKLOG	AVE. BACKLOG
1	2648	1687	740	221	1.65 qtrs
2	10591	8016	1421	1154	1.55 qtrs
3	2947	1327	312	1308	7.16 qtrs
4	1544	1002	149	393	5.31 qtrs

* BSR is a document identifier used by SPCC to cancel repair requirements.

These figures were made available to the DOPs at the last workload conference held in September 1985. As pointed out earlier, many of the DOPs were not canceling (BSR) carcasses that were not available during the quarter in hopes the carcasses would materialize in the future. Subsequent to this report, the DOPs have reduced the backlog by canceling many of the carcasses that were not available for induction.

SPCC recognizes that this information does not accurately reflect the backlog but is forced to use whatever information is available. In this case, the data on DLRs scheduled and completed is available via TIR reporting.



DOP BACKLOG AND PRODUCTIVITY ANALYSIS
DOP: NSY LONG BEACH (7H)

	DATE	UNITS SCHEDULED	COMPLETED	BSR		BACKLOG
1Q FY84	12/31/84 -	1888	1464	222		202
	6/30/85		1602	224		62
	Difference		138	2		140
2Q	12/31/84 -	1651	1288	271		92
	6/30/85		1345	272		34
	Difference		57	1		58
3Q	12/31/84 -	1467	1077	154		236
	6/30/85		1222	157		88
	Difference		145	3		148
4Q	12/31/84 -	1386	837	226		323
	6/30/85		980	235		171
	Difference		143	9		152
1Q FY85	12/31/84 -	2205	502	0		1703
	6/30/85		1720	151		334
	Difference		1218	151		1369
2Q	12/31/84 -	1994	0	0		1994
	6/30/85		1147	382		465
			1147	382		1529
TOTAL		10591	8016	1421	13%	1154
DIFFERENCE TOTALS			2848	548		3396

AVE UNITS SKED LAST 6 QTRS 10591/6 = 1765

AVE UNITS BSR'd LAST 6 QTRS 1421/6 = 236

AVE UNITS AVAILABLE FOR INDUCTION = 1529

AVE UNITS COMPLETED LAST 2 QTRS 785 + 2848/2 = 3633/2 = 1816

% COMPLETED VS AVAIL = 1 18%

UNITS REMAINING FROM PRIOR QUARTERS = 1154

UNITS REMAINING FROM CURRENT QUARTER MINUS PROJECTED BSRs = 1675

TOTAL UNITS IN BACKLOG = 2829

AVE UNITS COMPLETED = 1816

% OF UNITS IN BACKLOG = 1.55 QTRS

Figure 3.1 SPCC Backlog Computations Sample.

When units completed are used in the computations the work in-process is ignored. To accurately measure backlog, man-hours authorized should be compared to man-hours expended. With the exception of one DOP, man-hour information is not readily available. Only Long Beach NSY, which has ARMIS, can automatically generate man-hour information in a timely manner.

The author was faced with a similar problem in gathering statistical data for this thesis. A great deal of time was required to gather and compile the data at the non-automated shipyards. At one DOP the lack of any automated repairables management information by either the DOP or DSP, as well as time constraints, precluded gathering segmented RTAT on the DOP's performance. It is obviously difficult to determine what actions should be taken if accurate information on the current situation is not available.

C. DOP ORGANIZATION

1. General

Historically, the primary mission of naval shipyards has been to provide logistic support for the construction, conversion, overhaul, repair, alteration, and drydocking of U.S. Navy ships and service craft. Additionally, shipyards have been assigned depot responsibility for overhaul of DLRs.

At most shipyards the DLR workload accounts for less than five percent of the total shipyard effort [Ref. 11: p.11-3]. Consequently, shipyards are organized and management information systems have been set up to support the ship related work (ie. construction, conversion, overhauls, etc.).

Although the shipyard priority list indicates that the repair of DLRs is relatively high, the low volume of repairs as compared to the waterfront workload precludes most shipyard commanding officers from dedicating personnel to the repairables programs. In this thesis, dedicating personnel refers to having people assigned to a program on a permanent basis. For example, personnel dedicated to the repairables program would not be assigned to do work on ships on the waterfront. Their primary responsibility would be to repair DLRs.

During several of the interviews conducted for this thesis, repair of DLRs was referred to as "filler" work.[3] Without dedicated shop personnel to repair DLRs, repairables will continue to be used as filler work.

Most shipyards could survive without the DLR workload. However, the ICPs cannot survive without having organic DOPs. With the increasing number of DLRs (approximately 90,000 at SPCC alone) and the increasing complexity of weapons systems, it may be difficult for SPCC to locate commercial DOPs with the capability and capacity to provide timely repair of DLRs.

2. Proposed Organization

There was unanimous agreement between the shipyards visited and SPCC that the single most important factor in reducing RTAT at the shipyards was for NAVSEA and shipyard commanders to support the repairables program at their shipyards. If a repairables program is to be actively supported the shipyard needs to address four separate functions: (1) Planning, (2) Production, (3) Transportation and (4) Supply.

a. Planning

As a direct result of one of the audit reports mentioned above, Long Beach NSY established a dedicated planning office called the Repairables Management Office (RMO). Historically, this shipyard has been the largest DOP with respect to the number and value of DLRs repaired. It has been designated the DOP for over 4500 different DLRs,

---

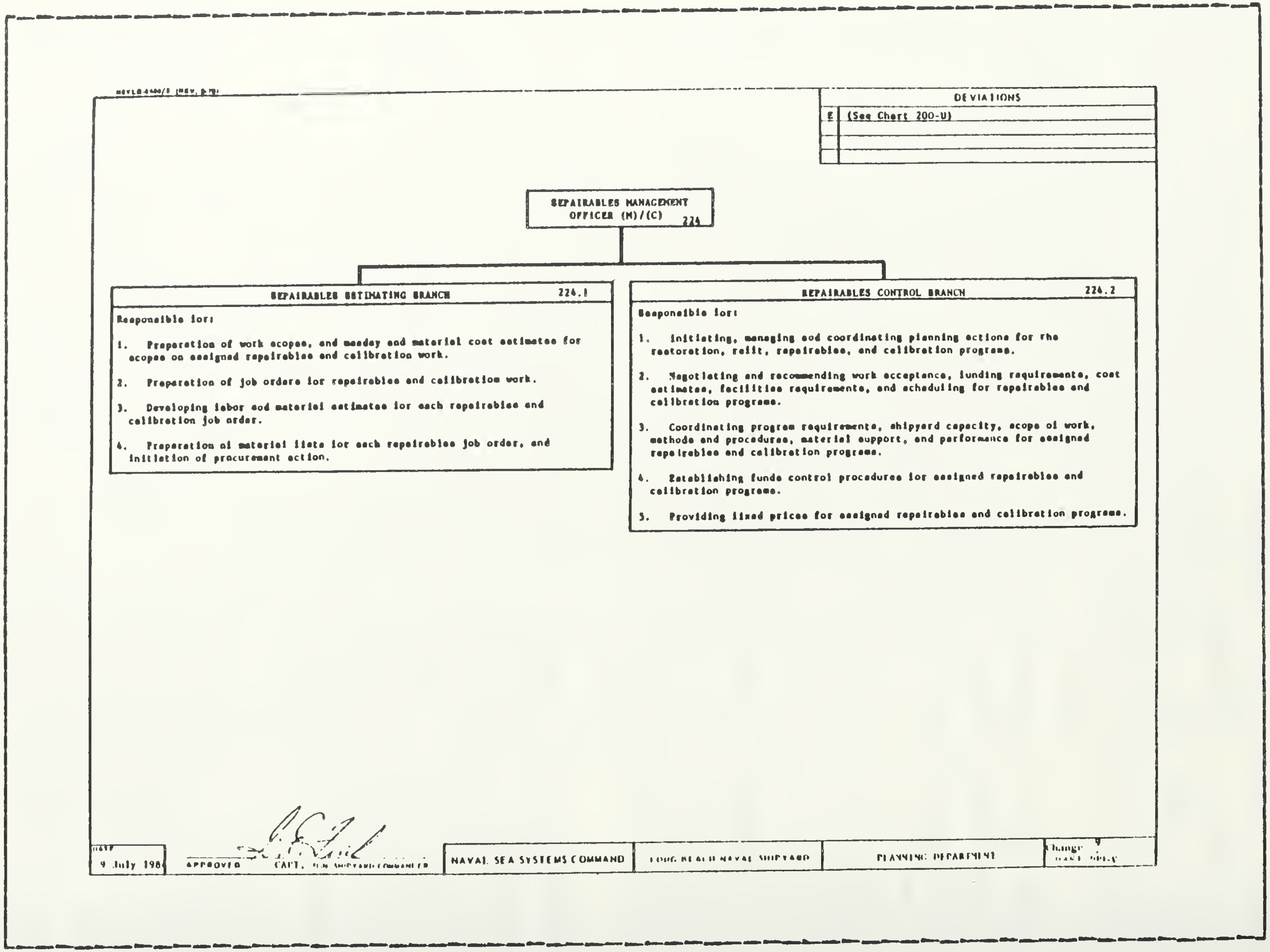
[3] Work that is accomplished when the waterfront workload is low and can not provide work for all the production workers.

3500 of which are managed by SPCC. The remainder are managed by NAVSEA and the old NAVELEX organization. In Fiscal Year (FY) 84 this DOP was funded over $65 million dollars to repair DLRs (this represents approximately ten percent of that shipyard's total workload).

Figure 3.2 is the NAVSEA approved organization chart for the Long Beach RMO. Figure 3.3 is a skeletonized organization chart that shows the relationship between the planning (RMC) and production (RRC) departments. The primary benefit of an RMO organization is the consolidation of the production controller and planner and estimater functions in one office. By having the P&E personnel in the same office and dedicated to repairables, the time required to generate the Work Control Document (WCD) / Job Order (JO) is reduced. The other major benefit of this organization structure is the centralization of authority and responsibility for managing repairables.

Due to the volume of repairables managed at Long Beach NSY, the number of PCs (5) and P&Es (6) is large when compared to other DOPs. The PCs are organized by DLR type. Two are assigned to SPCC items and two are assigned to NAVSEA items. One is assigned to manage the Pacific Fleet Winch Repair program. Three mechanical P&E, one electronic P&E, one electrical P&E and a P&E supervisor are fully employed in preparing WCDs and ordering material.

The most important factor is to have personnel dedicated to the program not the number assigned. For example, the smallest DOP analyzed in this thesis repairs approximately 500 DLRs for SPCC with funding less than $1 million dollars in FY 84 [Ref. 7]. Although this shipyard does not do the volume of DLR repairs that the larger shipyards do, the process and procedures involved in the administrative and repair functions are essentially the same. This shipyard does not need as many people assigned


DEVIATIONS
E (See Chart 200-U)
REPAIRABLES MANAGEMENT OFFICER (M)/(C) 224
REPAIRABLES ESTIMATING BRANCH 224.1
REPAIRABLES CONTROL BRANCH 224.2
DATE 9 July 198
APPROVED CAPT., USN SHIPYARD COMMANDER
NAVAL SEA SYSTEMS COMMAND
LONG BEACH NAVAL SHIPYARD
PLANNING DEPARTMENT
Change 9

REPAIRABLES ESTIMATING BRANCH 224.1

Responsible for:

1. Preparation of work scopes, and manday and material cost estimates for scopes on assigned repairables and calibration work.
2. Preparation of job orders for repairables and calibration work.
3. Developing labor and material estimates for each repairables and calibration job order.
4. Preparation of material lists for each repairables job order, and initiation of procurement action.

REPAIRABLES CONTROL BRANCH 224.2

Responsible for:

1. Initiating, managing and coordinating planning actions for the restoration, refit, repairables, and calibration programs.
2. Negotiating and recommending work acceptance, funding requirements, cost estimates, facilities requirements, and scheduling for repairables and calibration programs.
3. Coordinating program requirements, shipyard capacity, scope of work, methods and procedures, material support, and performance for assigned repairables and calibration programs.
4. Establishing funds control procedures for assigned repairables and calibration programs.
5. Providing fixed prices for assigned repairables and calibration programs.

Figure 3.2 NAVSEA approved Repairables Management Office.

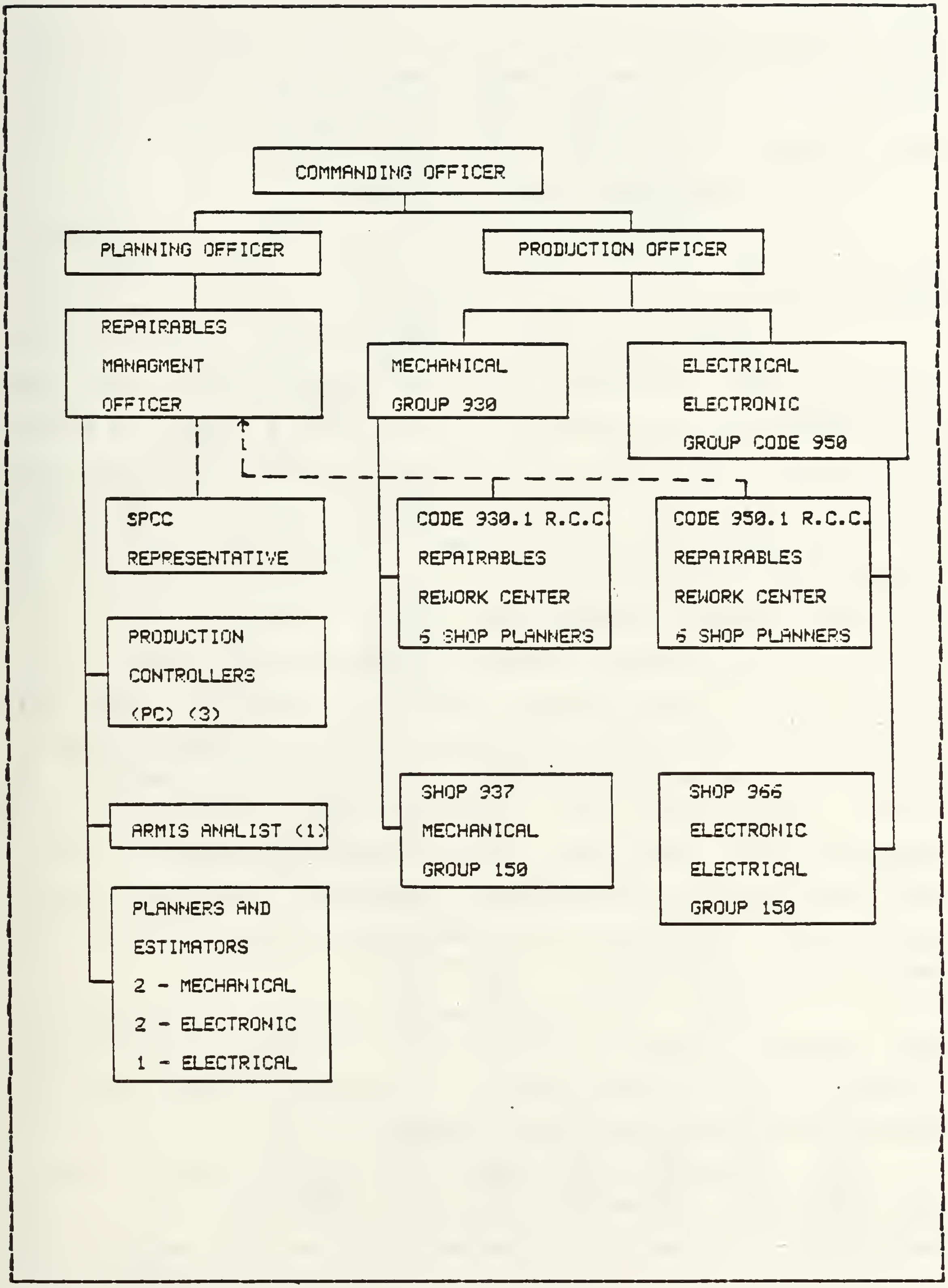

COMMANDING OFFICER
PLANNING OFFICER
PRODUCTION OFFICER
REPAIRABLES MANAGMENT OFFICER
MECHANICAL GROUP 930
ELECTRICAL ELECTRONIC GROUP CODE 950
SPCC REPRESENTATIVE
CODE 930.1 R.C.C. REPAIRABLES REWORK CENTER 6 SHOP PLANNERS
CODE 950.1 R.C.C. REPAIRABLES REWORK CENTER 6 SHOP PLANNERS
PRODUCTION CONTROLLERS (PC) (3)
ARMIS ANALIST (1)
SHOP 937 MECHANICAL GROUP 150
SHOP 966 ELECTRONIC ELECTRICAL GROUP 150
PLANNERS AND ESTIMATORS
2 - MECHANICAL
2 - ELECTRONIC
1 - ELECTRICAL

Figure 3.3 Long Beach NSY RMO and RRC Organization.

to the repairables program but it does need a dedicated organization with centralized authority and responsibility. At this DOP only one PC is used for managing the entire repairables program.

b. Repairables Rework Centers

Repairable Rework Centers (RRC) are designed to have dedicated mechanics and shop planners assigned to work centers whose primary responsiblity is the repair of DLRs.

RRCs were first introduced into selected shipyards in 1978. Currently, only two shipyards have RRCs (NSY Long Beach and NSY Norfolk). The driving factor in establishing RRCs dates back to 1975 when several shipyards were faced with (1) major reductions in the waterfront workloads, (2) underutilization of electronic repair facilities and (3) a need to provide customers a lower priced cost center[4] due to rework funding deficiencies. [Ref. 11: p. I-1.]

In 1981 an RRC was formally established in the Electronic/Electrical Group (Code 950) at Long Beach NSY. Efforts are also being taken to establish a similar organization in the Mechanical Group (Code 930). Recently the LBNSY organization was expanded to include a Shop Superintendent (Code 966). A shop superintendent is responsible for several work centers. Currently there are approximately 300 dedicated shop personnel assigned to the two RRCs at Long Beach NSY.

About the same time an RRC was established in the Electronic Shop at Norfolk NSY. Although not formally organized, the Norfolk RRC has continued to have personnel dedicated to the repairables program.

Figure 3.4 is the formal organizational chart of the Electronic / Electrical Group (Code 950) RRC at Long Beach NSY. This is the largest RRC at any shipyard and

---

[4] lower priced cost centers refer to establishing tailored stabilized rates for DLR repairs.

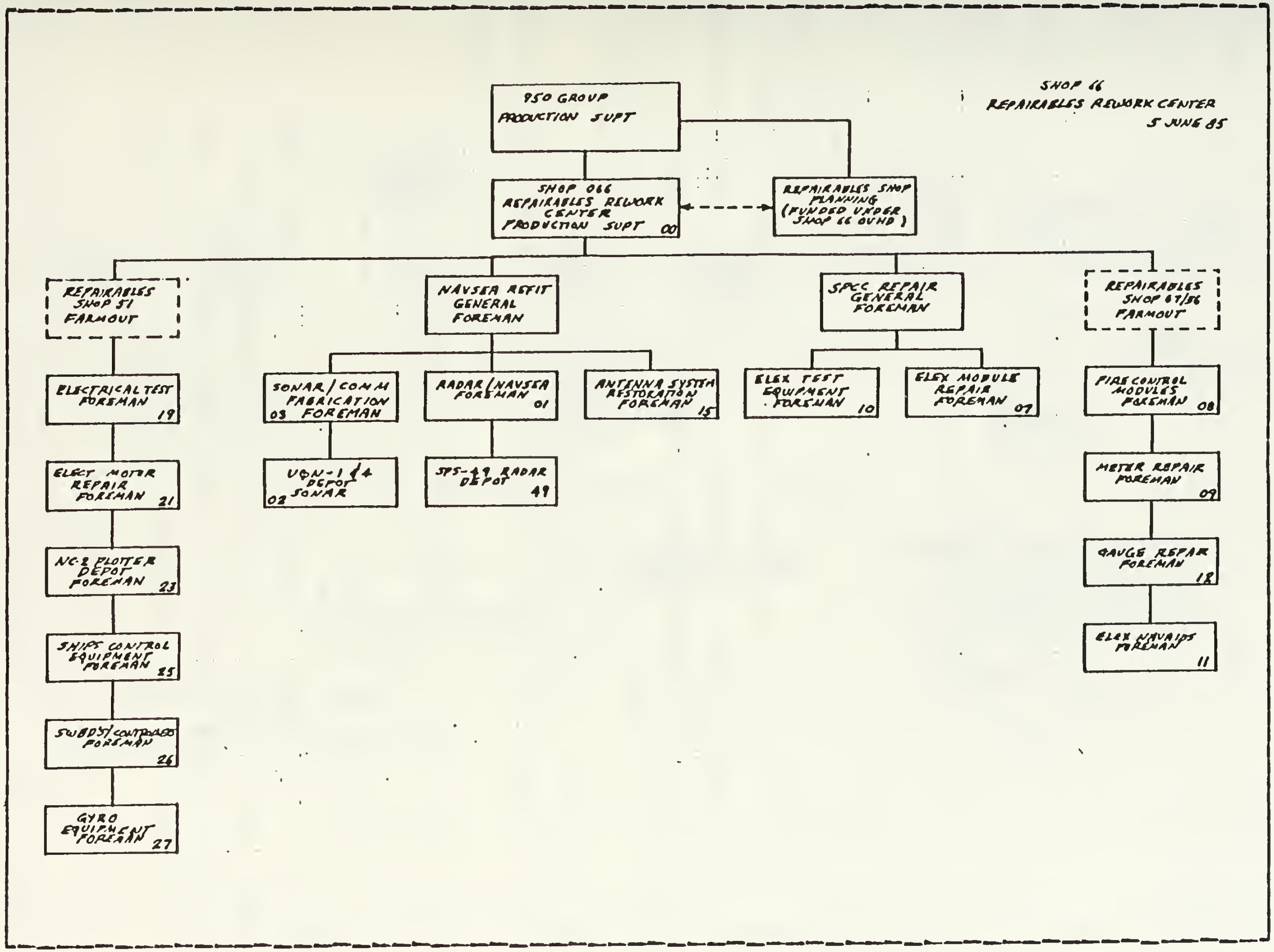
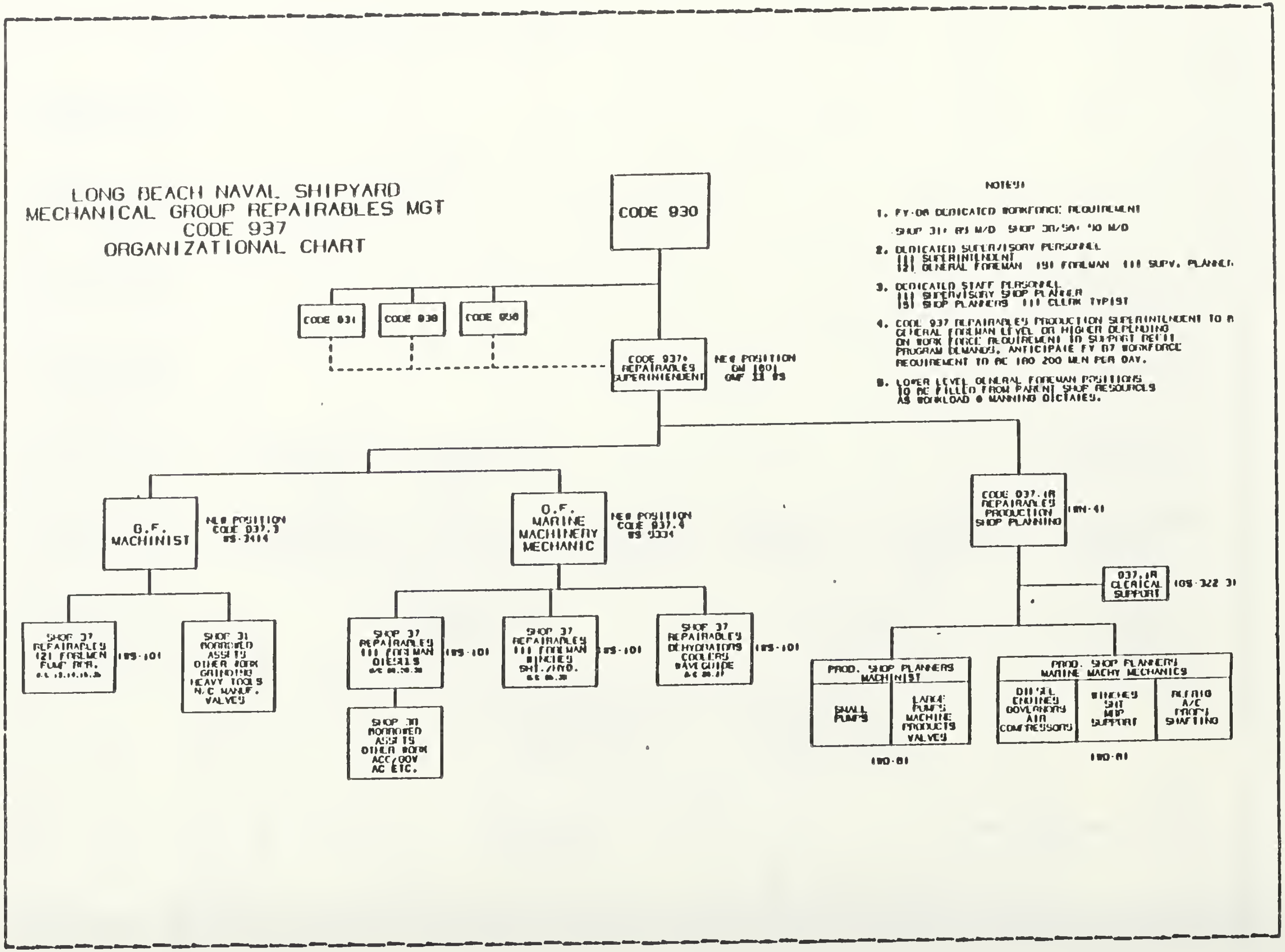

SHOP 66
REPAIRABLES REWORK CENTER
5 JUNE 85
950 GROUP PRODUCTION SUPT
SHOP 066 REPAIRABLES REWORK CENTER PRODUCTION SUPT 00
REPAIRABLES SHOP PLANNING (FUNDED UNDER SHOP 66 OVHD)
REPAIRABLES SHOP 51 FARMOUT
NAVSEA REFIT GENERAL FOREMAN
SPCC REPAIR GENERAL FOREMAN
REPAIRABLES SHOP 67/56 FARMOUT
ELECTRICAL TEST FOREMAN 19
ELECT MOTOR REPAIR FOREMAN 21
NC-2 PLOTTER DEPOT FOREMAN 23
SHIPS CONTROL EQUIPMENT FOREMAN 25
SUBDS/CONTROLS FOREMAN 26
GYRO EQUIPMENT FOREMAN 27
SONAR/COMM FABRICATION 03 FOREMAN
UQN-1 & 4 DEPOT 02 SONAR
RADAR/NAVSEA FOREMAN 01
SPS-49 RADAR DEPOT 49
ANTENNA SYSTEM RESTORATION FOREMAN 15
ELEX TEST EQUIPMENT FOREMAN 10
ELEX MODULE REPAIR FOREMAN 07
FIRE CONTROL MODULES FOREMAN 08
METER REPAIR FOREMAN 09
GAUGE REPAIR FOREMAN 18
ELEX NAVAIDS FOREMAN 11

Figure 3.4 Electronic / Electrical RRC.


LONG BEACH NAVAL SHIPYARD
MECHANICAL GROUP REPAIRABLES MGT
CODE 937
ORGANIZATIONAL CHART
CODE 930
CODE 931
CODE 938
CODE 956
CODE 937: REPAIRABLES SUPERINTENDENT
NEW POSITION GM 13(0) OWF 11 WS
G.F. MACHINIST
NEW POSITION CODE 937.3 WS-3414
G.F. MARINE MACHINERY MECHANIC
NEW POSITION CODE 937.4 WS 5334
CODE 937.1R REPAIRABLES PRODUCTION SHOP PLANNING
WN-41
937.1R CLERICAL SUPPORT
GS-322 3
SHOP 37 REPAIRABLES (2) FOREMEN PUMP RPR.
WS-101
SHOP 31 BORROWED ASSETS OTHER WORK GRINDING HEAVY TOOLS N/C MANUF. VALVES
SHOP 37 REPAIRABLES (1) FOREMAN DIESELS
WS-101
SHOP 38 BORROWED ASSETS OTHER WORK ACC/GOV AC ETC.
SHOP 37 REPAIRABLES (1) FOREMAN WINCHES SHT./HYD.
WS-101
SHOP 37 REPAIRABLES DEHYDRATORS COOLERS WAVEGUIDE
WS-101
PROD. SHOP PLANNERS MACHINIST
SMALL PUMPS
LARGE PUMPS MACHINE PRODUCTS VALVES
WD-81
PROD. SHOP PLANNERS MARINE MACHY MECHANICS
DIESEL ENGINES GOVERNORS AIR COMPRESSORS
WINCHES SHT MRP SUPPORT
REFRIG A/C PROPS SHAFTING
WD-81

NOTES:

1. FY-88 DEDICATED WORKFORCE REQUIREMENT
   SHOP 31: 83 M/D SHOP 38/56: 10 M/D
2. DEDICATED SUPERVISORY PERSONNEL
   (1) SUPERINTENDENT
   (2) GENERAL FOREMAN (9) FOREMAN (1) SUPV. PLANNER
3. DEDICATED STAFF PERSONNEL
   (1) SUPERVISORY SHOP PLANNER
   (5) SHOP PLANNERS (1) CLERK TYPIST
4. CODE 937 REPAIRABLES PRODUCTION SUPERINTENDENT TO BE GENERAL FOREMAN LEVEL OR HIGHER DEPENDING ON WORK FORCE REQUIREMENT TO SUPPORT RECTT PROGRAM DEMANDS. ANTICIPATE FY 87 WORKFORCE REQUIREMENT TO BE 180 200 MEN PER DAY.
5. LOWER LEVEL GENERAL FOREMAN POSITIONS TO BE FILLED FROM PARENT SHOP RESOURCES AS WORKLOAD & MANNING DICTATES.

Figure 3.5 Mechanical RRC.

employs approximately 150 personnel. Figure 3.5 is the proposed Mechanical Group (Code 930) RRC. Although the formal organization has not been fully implemented, this RRC also has approximately 150 personnel working on DLRs each day.

The larger an organization is the greater the need for a formalized structure. However, size is not the only criterion that should be used to justify a formal organization. Even the shipyard that does the least amount of DLR repairs has enough work to establish an RRC. Instead of 150 people it could be as few as 15. A minimum of one shop planner needs to be assigned to monitor induction, repairs in process and the steps for returning DLRs in "A" condition. The number of shop personnel assigned should be based on the number of man-years of work accepted by the DOP. If the DOP accepts the work it should be willing to dedicate the people to do the work. As the workload increases so can the the size of the RRC.

In the years since RRCs were first introduced in naval shipyards, major benefits and improvements have resulted for DLR customers.

1. Repair prices have been reduced. RRCs allow the shipyards to segregate the repairs of DLRs and organize the work force. By making repairs in a production mode, separate stabilized rates can be developed for each work center. Prior to the RRC concept, DLRs were repaired using the applicable ship rate. NSY Long Beach has 25 different rates based on the type of equipment, complexity of the repair and piece part requirements.

At NSY Long Beach analyzing the repair price has been made much easier using ARMIS. ARMIS retains cost information for material, labor and overhead by DLR. Actual charges are compared with estimates to determine if the repairs have been priced correctly and the rates are adjusted accordingly. Rates are submitted and approved by NAVSEA annually.

2. Dedicated personnel were assigned to repair DLRs.
3. RTAT was reduced. Table II is a summary of 7G, 7H and 7Z cog RTATs over the last five years at NSY Long Beach. RTAT has been reduced from over 100 days in FY-81 to just under 50 days for those FY-85 DLRs that have been completed to date.

TABLE II

HISTORY OF RTAT BY COG. FOR NSY LONG BEACH

YEAR	COG	UNITS COMPLETE	AVE.RTAT
FY-81	7G	1533	100
FY-81	7H	927	114
FY-81	7Z	N/A	N/A
FY-82	7G	5442	98
FY-82	7H	N/A	N/A
FY-82	7Z	2588	109
FY-83	7G	1426	112
FY-83	7H	4151	96
FY-83	7Z	435	102
FY-84	7G	1248	74
FY-84	7H	4811	72
FY-84	7Z	703	87
FY-85	7G	145	47
FY-85	7H	623	46
FY-85	7Z	91	50

Although comparable data was not readily available at Norfolk's RRC, SPCC personnel are confident the RRC concept has reduced RTAT significantly at that shipyard also. [Ref. 9]

Table III groups NSY Long Beach repair history data for the Electronic/Electrical RRC by cog and RTAT. Based on this information, approximately fifty percent of both the 7G and 7H cog DLRs have RTATs less than 60 days. When the data is reviewed in this way the manager can concentrate his attention on those DLRs that have excessive

RTATs. ARMIS can also list the individual NSNs that make up each category.

TABLE III

REPAIR TURN AROUND TIME

7G Cog RTAT for 307 NSNs

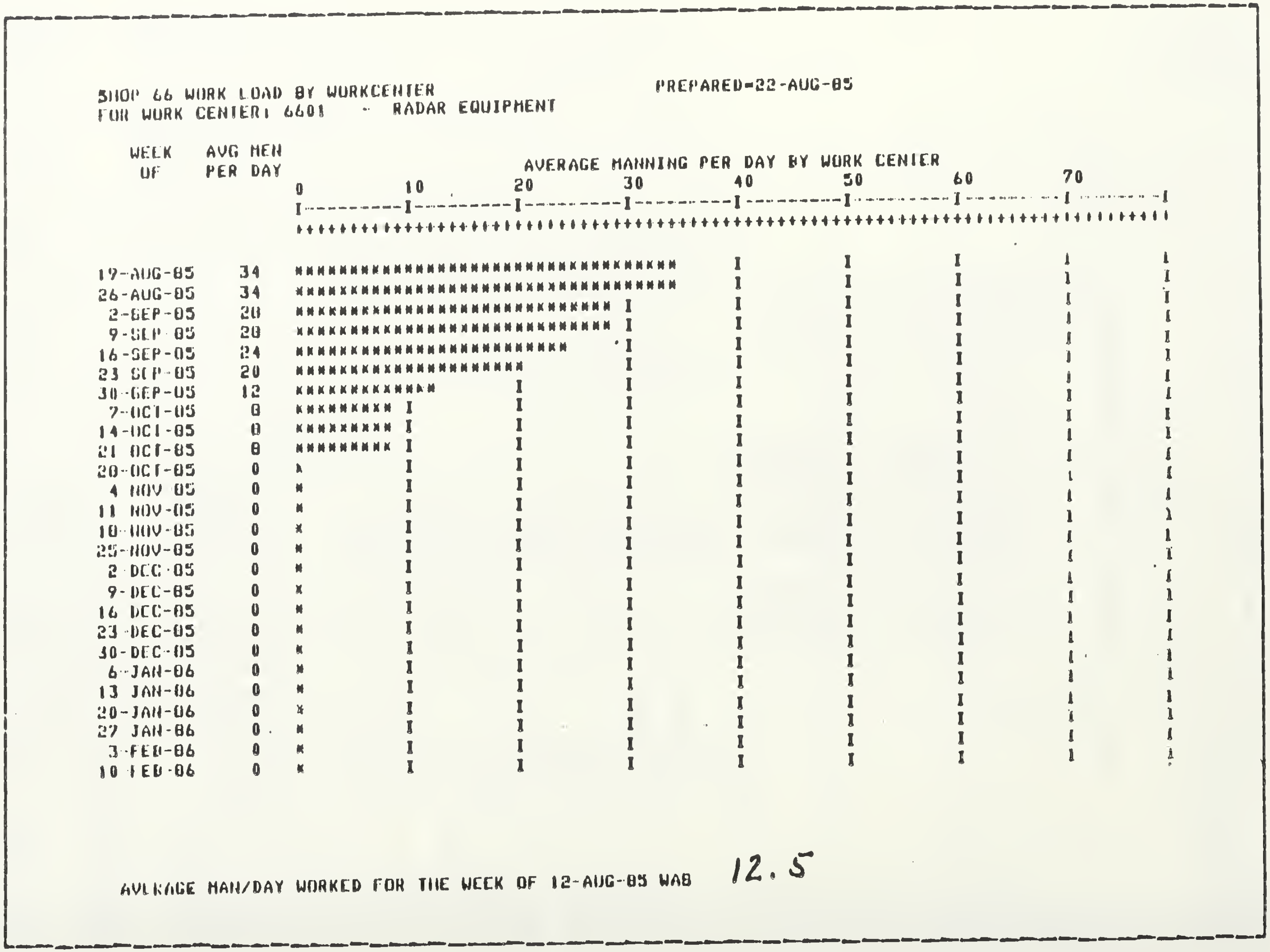
less than 60 days = 162
60 to 90 days = 52
90 to 120 days = 24
above 120 days = 69

7H Cog RTAT for 1005 NSNs

less than 60 days = 499
60 to 90 days = 140
90 to 120 days = 77
above 120 days = 289

Using the ARMIS in conjunction with the RRC, shop performance can be monitored to the shop foreman level. Figure 3.6 is a sample of a shop manning report obtained using the RRC and ARMIS combination. Using the number of man hours authorized and the number of man-hours expended, ARMIS computes the number of men needed to complete the work assigned to a foreman. This figure is compared to the number of personnel which worked the previous week. In this sample, the shop foreman has enough work to keep 35 people employed for the next two weeks and 28 people employed the following week and so on. However, the foreman worked only 12.5 people last week. If this foreman is going to meet his Repair in Process Times (RIPTs) he will have to assign more personnel. With this type of information available the manager can foresee problems such as, inadequate staffing, and take corrective action.

Appendix B contains flow charts of how the RRC at Long Beach uses ARMIS to process WCDs and induct carcasses for repair. [Ref. 13]



```
SHOP 66 WORK LOAD BY WORKCENTER                        PREPARED=22-AUG-85
FOR WORK CENTER: 6601    -  RADAR EQUIPMENT

  WEEK    AVG MEN
   OF     PER DAY               AVERAGE MANNING PER DAY BY WORK CENTER
                   0         10        20        30        40        50        60        70

19-AUG-85    34
26-AUG-85    34
 2-SEP-85    28
 9-SEP-85    28
16-SEP-85    24
23-SEP-85    20
30-SEP-85    12
 7-OCT-85     8
14-OCT-85     8
21-OCT-85     8
28-OCT-85     0
 4-NOV-85     0
11-NOV-85     0
18-NOV-85     0
25-NOV-85     0
 2-DEC-85     0
 9-DEC-85     0
16-DEC-85     0
23-DEC-85     0
30-DEC-85     0
 6-JAN-86     0
13-JAN-86     0
20-JAN-86     0
27-JAN-86     0
 3-FEB-86     0
10-FEB-86     0

AVERAGE MAN/DAY WORKED FOR THE WEEK OF 12-AUG-85 WAS   12.5
```

Figure 3.6 Shop Manning Requirements Sample Report.

c. Transportation Services

There are two support services that directly effect RTAT at shipyards; (1) transportation and (2) supply support services.

Transportation problems, both within the shipyard and between the DOP and DSP, were found to be increasing RTAT at all four shipyards visited. In most cases the delays occurred when failed carcasses were being moved in or out of the DOP. In one case, completed DLRs were staged in a large box prior to being delivered to the DSP. This box, because of its size , is only picked up once a week and then only if it is full [Ref. 12]. This practice automatically adds an average of three and a half days to the repair in process time for those items staged in the box.

Another problem that has caused delays is the losing of carcasses after the induction request has been made. At one shipyard, a sample of six FY 85 project orders involving 1493 carcasses was reviewed. Of the 1493 carcasses, 294 or 20 percent were shipped from the DSP but not received. Because there was no DOP or DSP monitoring of the movement of the carcasses it is difficult to determine the disposition of these carcasses. Due to the large number of carcasses that are reported shipped but not received, several of the shipyards have instituted signature receipt. Previously, the DSP driver was dropping the carcasses off at the DOP without requiring a signature [Ref. 13]. Signature control has added some time to the receipt process but has reduced the number of lost carcasses.

Shipyards without RRCs have DLRs delivered to the Material Control Centers (MCC) in the various shops. MCCs are designed primarily to stage material coming off ships in overhaul as well as material being returned to the ships when repairs have been completed. To help eliminate the impact of transportation delays between the DSP and DOP, the DSP that supports Long Beach NSY has begun making daily pick up and delivery at the RRC. By making deliveries and pick-ups at the RRC, the shop planners have more control and visibility of the DLR. Having the RRC control movement of DLRs also reduces the chance the material will be mixed with DLR being repaired for ships on the waterfront.[5]

Finally, arranging transportation/materials handling services within the DOP has also been difficult due to competition from the waterfront workload for cranes and other materials handling equipment. These delays can increase RTAT unnecessarily.

d. Supply Support Services

Organizing certain DOP supply activities or functions to support the repairables program could have a significant impact on reducing RTAT. Two functions that are important are : (1) shop stores support and (2) expediting of piece parts used to repair DLRs.

Two of the shipyards visited cited instances where shop stores' personnel were not supporting the repairables program. In both cases shop personnel directly involved in the repair process had provided shop store managers with lists (approximately 2000 NSNs each) of material they felt were needed to support the repair of particular DLRs. According to the personnel interviewed, no action was taken to stock these items in shop stores. Management attention and affirmative action on the production shop's request for support would obviously eliminate delays caused by lack of repair part support. [Ref. 13, 14].

---

[5] Concurrent repair of DLRs is not normally authorized and causes inaccurate demand data for the Supply system. Concurrent repair is when the operating ship or activity has the DLR repaired at the DOP without notifying the IM. Concurrent repair is a significant problem but will not be addressed in this thesis.

Once piece parts have been placed on order it is the shipyard supply department's responsibility to expedite material based on priority and urgency of need. Only one DOP indicated they had a dedicated expediter assigned to the repairables program [Ref. 13]. At the other shipyards expediting piece parts for the repairables program was considered in direct competition with waterfront requirements. As indicated earlier, at most shipyards DLR work is accomplished only when it doesn't interfere with the waterfront work.

D. WORKLOAD FORECASTING

Workload forecasting is a key factor in reducing RTAT. Without a steady and reliable workload it is very difficult for the DOP to schedule man-power and machines to support a repairables program in shipyards. When the planned workload is not available at the beginning of the quarter, production workers will be left idle or must be reassigned. If carcasses arrive later during the quarter in which they were workloaded, repairs will normally be delayed until the carcasses can be inducted and personnel reassigned. Such inaccuracies in the forecasted workload can and do cause major problems for the DOPs.

If the DOP can be assured of a consistent workload it can staff the the shops accordingly and integrate the DLR workload with ship repairs. Consistency of the workload is more important than volume. The volume of work only becomes important when the shop has been manned to meet a certain workload level. For those organic DOPs who repair a large number of DLRs each quarter, RRCs have been established which have dedicated shop personnel. These personnel rely on the forecasted workload to keep them employed for the entire quarter. If the actual workload is less than the forecasted workload, the RRC manager must schedule the inductions over the entire quarter even though he could repair the carcasses faster [Ref. 12].

Workload forecasting is the responsibility of SPCC and has a direct effect on many of the policies and practices adopted by shipyards. SPCC's policy in recent years has been to workload only those non-ready for issue (NRFI) carcasses that are on hand at a DSP or are due in from operating units. This policy was put into effect due to a number of complaints by the DOPs that carcasses were not available for repair after they had been workloaded.

Although some improvements in carcass availability has been made, there still seems to be a problem. Using the DOP's monthly refit reports, sample data was extracted to determine the percentage of workloaded carcasses that are subsequently cancelled because the carcass was mis-identified or was not on-hand at the DSP. At one DOP a sample of three project orders covering the first three quarters of FY-85 revealed that only 42 per cent of the 118 different 7H cog stock numbers workloaded actually had carcasses available. Repairs to 69 of these stock numbers were cancelled because the DSP did not have carcasses available or when the carcass was delivered to the DOP it had been mis-identified and was a carcass for some other NSN.

A similar sample was taken at another DOP. This sample involved six FY-85 project orders to repair 204 different stock numbers with varying quantities of carcasses assigned to each NSN. 438 of these carcasses, involving 71 NSNs, were either not in stock (NIS), not received or mis-identified.

This information does not significantly differ from the information available at SPCC. In a recent briefing SPCC noted that the carcass cancellation (BSR) rate has averaged approximately 22 percent at organic DOPs. [Ref. 15]

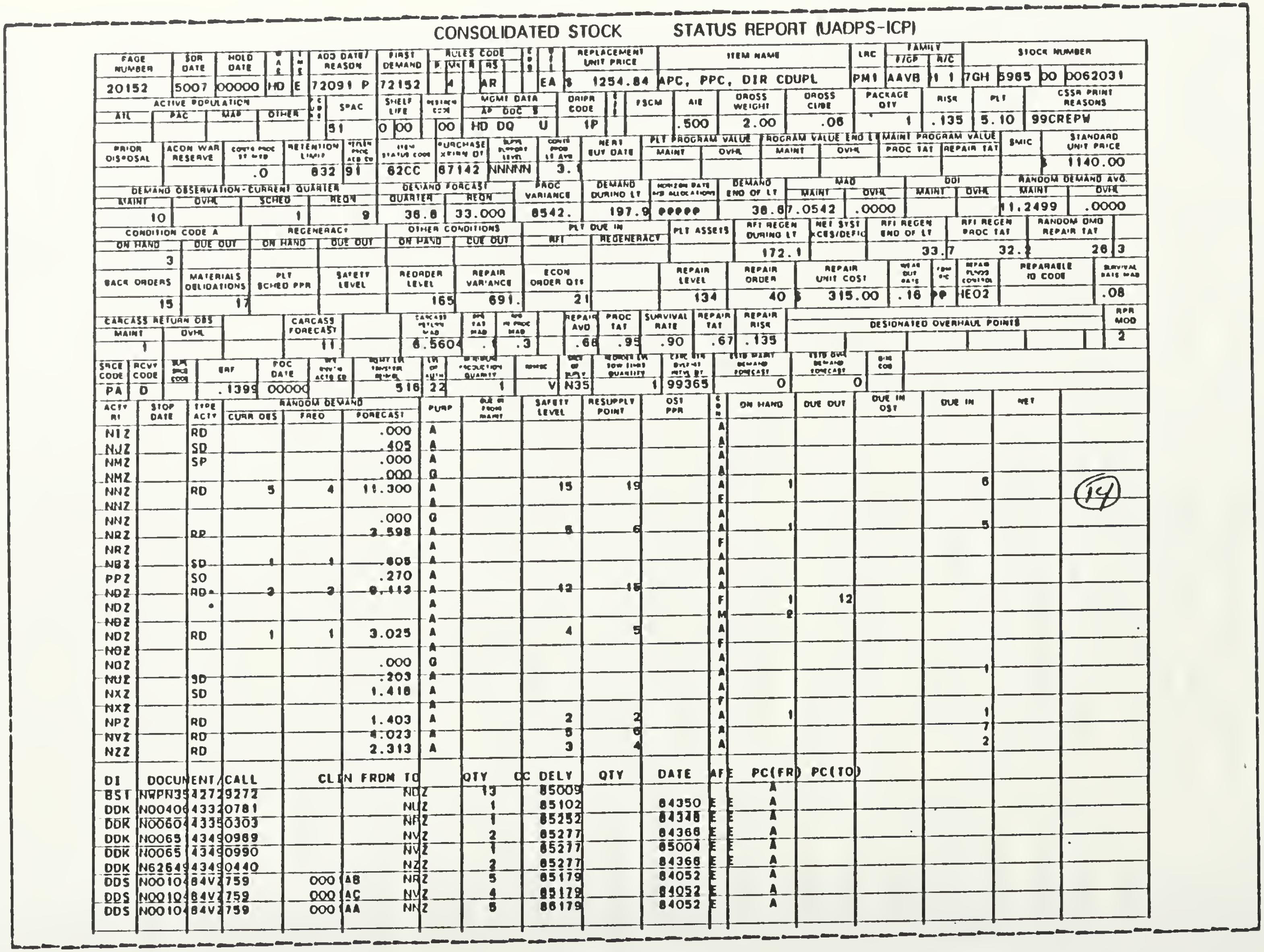
The recently established Repairables Policy and Systems Office (Code 0503) at SPCC is trying to identify and take corrective action on the problems of repairables management.

In addition to carcass availability, this office is investigating problems with carcass visibility, DOP management, repair requirement identification, institutional issues, ADP issues and financial issues. [Ref. 15]

Much of the carcass timing problem is a result of the operating units not being timely in returning their failed carcasses. If the carcass does not arrive at the DSP during the quarter it was workloaded, repair of that carcass is cancelled by SPCC. Eliminating planning for due-in quantities would improve the accuracy of the workload forecast. Thus, if SPCC were to base the workload solely on on-hand non-RFI carcasses, the percentage of available carcasses should increase.

Another action that may improve workload forecasting is to develop an automated interface between the B08 and the shipyard's computer system. The Aviation Support Office (ASO) uses a magnetic tape of the Cyclic Repairables Management Program (B08) to workload the Naval Air Rework Facilities (NARF) on a weekly basis. The NARF receives 90 percent of its workload automatically by interfacing the B08 tape with the NARF's weekly induction scheduling system. [Ref. 6].

Under the present system used by SPCC and organic DOPs, 90 percent of the workload must be accomplished manually by reviewing over 19,000 NSNs each quarter. Figure 3.7 and 3.8 are samples of two of the forms that must be reviewed by the IM for each NSN. For each of the NSNs workloaded the IM must compare and verify the actual stock status on the Consolidated Stock Status Report (CSSR) with the forecasted workload figures on the repair workload forecast. The UADPS Supply Demand Review program provides the CSSR forms and SPCC's DATAPOINT system computes the workload forecast. DATAPOINT receives information on a selected universe of NSNs via magnetic tape from UADPS. For example, UADPS may



CONSOLIDATED STOCK STATUS REPORT (UADPS-ICP)

PAGE NUMBER: 20152
SDR DATE: 5007
HOLD DATE: 00000
HD
E
ADD DATE/REASON: 72091 P
FIRST DEMAND: 72152
RULES CODE: 4 AR
EA
REPLACEMENT UNIT PRICE: $ 1254.84
ITEM NAME: APC, PPC, DIR COUPL
LRC: PM1
FAMILY F/GP: AAVB
R/C: 1 1
STOCK NUMBER: 7GH 5985 00 0062031

ACTIVE POPULATION: ATL PAC MAP OTHER
SPAC: 51
SHELF LIFE: 0 00
00
MGMT DATA AP DOC: HD DQ U
DRIPR CODE: 1P
FSCM
AIE: .500
GROSS WEIGHT: 2.00
GROSS CUBE: .06
PACKAGE QTY: 1
RISK: .135
PLT: 5.10
CSSR PRINT REASONS: 99CREPW

PRIOR DISPOSAL
ACON WAR RESERVE
.0
RETENTION LIMIT: 832
91
62CC
PURCHASE: 67142
NNNNN
3.
NEXT BUY DATE
PLT PROGRAM VALUE: MAINT OVHL
PROGRAM VALUE END LT: MAINT OVHL
MAINT PROGRAM VALUE: PROC TAT REPAIR TAT
SMIC
STANDARD UNIT PRICE: $ 1140.00

DEMAND OBSERVATION-CURRENT QUARTER: MAINT 10; OVHL; SCHED 1; REQN 9
DEMAND FORCAST: QUARTER 36.6; REQN 33.000
PROC VARIANCE: 8542.
DEMAND DURING LT: 197.9
●●●●●
DEMAND END OF LT: 38.6
MAD: MAINT 7.0542; OVHL .0000
DDI: MAINT OVHL
RANDOM DEMAND AVG: MAINT 11.2499; OVHL .0000

CONDITION CODE A: ON HAND 3; DUE OUT
REGENERACY: ON HAND; DUE OUT
OTHER CONDITIONS: ON HAND; DUE OUT
PLT DUE IN: RFI; REGENERACY
PLT ASSETS
RFI REGEN DURING LT: 172.1
NET SYST XCES/DEFIC
RFI REGEN END OF LT: 33.7
RFI REGEN PROC TAT: 32.
RANDOM DMD REPAIR TAT: 26
3

BACK ORDERS: 15
MATERIALS OBLIGATIONS: 17
PLT SCHED PPR
SAFETY LEVEL
REORDER LEVEL: 165
REPAIR VARIANCE: 691.
ECON ORDER QTY: 21
REPAIR LEVEL: 134
REPAIR ORDER: 40
REPAIR UNIT COST: $ 315.00
.16
PP
HE02
REPARABLE ID CODE
.08

CARCASS RETURN OBS: MAINT 1; OVHL
CARCASS FORECAST: 11
6.5604
.
.3
REPAIR AVG: .66
PROC TAT: .95
SURVIVAL RATE: .90
REPAIR TAT: .67
REPAIR RISK: .135
DESIGNATED OVERHAUL POINTS
RPR MOD: 2

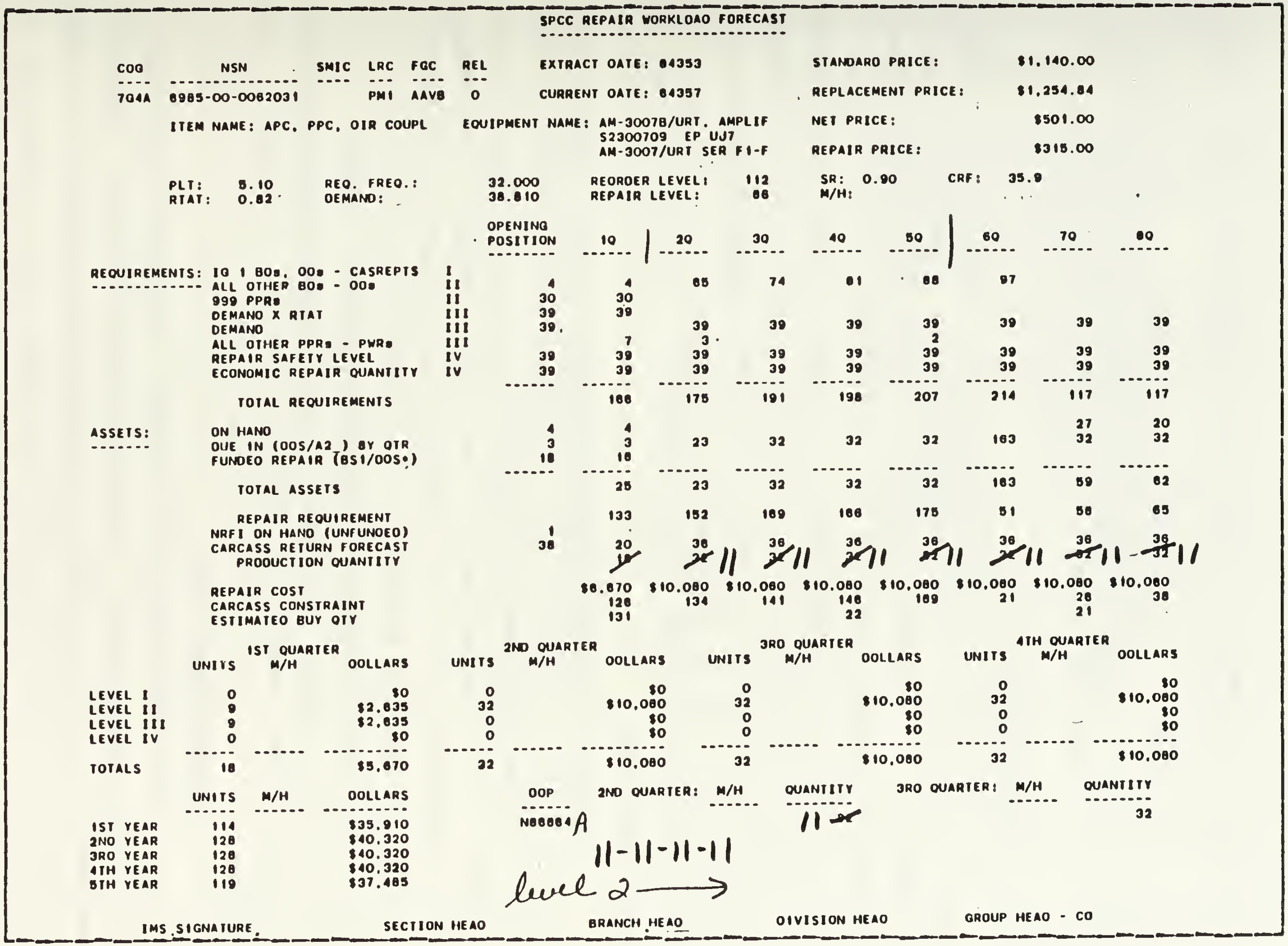
SRCE CODE: PA
RCVY CODE: D
ERF: .1399
POC DATE: 00000
516
22
1
V
N35
1
99365
0
0

ACTV RI	STOP DATE	TYPE ACTV	RANDOM DEMAND CURR OBS	FREQ	FORECAST	PURP		SAFETY LEVEL	RESUPPLY POINT	OST PPR	COND	ON HAND	DUE OUT	DUE IN OST	DUE IN	NET
NIZ		RD			.000	A					A					
NJZ		SD			.405	A					A					
NMZ		SP			.000	A					A					
NMZ					.000	G					A					
NNZ		RD	5	4	11.300	A		15	19		A	1			6	
NNZ						A					E					
NNZ					.000	G					A					
NRZ		RP			2.598	A		5	6		A	1			5	
NRZ						A					F					
NBZ		SD	1	1	.605	A					A					
PPZ		SO			.270	A					A					
NDZ		RD	2	2	8.112	A		12	15		A					
NDZ		•				A					F	1	12			
NDZ						A					M	2				
NDZ		RD	1	1	3.025	A		4	5		A					
NDZ						A					F					
NDZ					.000	G					A					
NUZ		SD			.203	A					A				1	
NXZ		SD			1.418	A					A					
NXZ						A					F					
NPZ		RD			1.403	A		2	2		A	1			1	
NVZ		RD			4.023	A		5	6		A				7	
NZZ		RD			2.313	A		3	4		A				2	

DI	DOCUMENT/CALL	CL N	FROM TO	QTY	OC DELY	QTY	DATE	AFE	PC(FR)	PC(TO)
BST	NWPN3542729272		NDZ	13	85009				A	
DDK	N0040643320781		NUZ	1	85102		84350	E E	A	
DDK	N0060443350303		NRZ	1	85252		84348	E E	A	
DDK	N0065 43490989		NVZ	2	85277		84368	E E	A	
DDK	N0065 43490990		NVZ	1	85277		85004	E E	A	
DDK	N6264943490440		NZZ	2	85277		84368	E E	A	
DDS	N0010484V2759	000 AB	NRZ	5	85179		84052	E	A	
DDS	N0010484V2759	000 AC	NVZ	4	85179		84052	E	A	
DDS	N0010484V2759	000 AA	NNZ	5	86179		84052	E	A	

14

Figure 3.7 Consolidated Stock Status Report.



SPCC REPAIR WORKLOAD FORECAST

COG	NSN	SMIC	LRC	FGC	REL
7Q4A	6985-00-0062031		PM1	AAV8	0

EXTRACT DATE: 84353

CURRENT DATE: 84357

STANDARD PRICE: $1,140.00

REPLACEMENT PRICE: $1,254.84

NET PRICE: $501.00

REPAIR PRICE: $315.00

ITEM NAME: APC, PPC, OIR COUPL

EQUIPMENT NAME: AM-3007B/URT, AMPLIF
S2300709 EP UJ7
AM-3007/URT SER F1-F

PLT: 5.10
RTAT: 0.82

REQ. FREQ.: 32.000
DEMAND: 38.810

REORDER LEVEL: 112
REPAIR LEVEL: 66

SR: 0.90
M/H:

CRF: 35.9

			OPENING POSITION	1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q
REQUIREMENTS:	IQ 1 BOs, OOs - CASREPTS	I									
	ALL OTHER BOs - OOs	II	4	4	65	74	81	88	97		
	999 PPRs	II	30	30							
	DEMAND X RTAT	III	39	39							
	DEMAND	III	39.		39	39	39	39	39	39	39
	ALL OTHER PPRs - PWRs	III		7	3			2			
	REPAIR SAFETY LEVEL	IV	39	39	39	39	39	39	39	39	39
	ECONOMIC REPAIR QUANTITY	IV	39	39	39	39	39	39	39	39	39
	TOTAL REQUIREMENTS			166	175	191	198	207	214	117	117
ASSETS:	ON HAND		4	4						27	20
	DUE IN (DOS/A2_) BY QTR		3	3	23	32	32	32	163	32	32
	FUNDED REPAIR (BS1/DOS*)		18	18							
	TOTAL ASSETS			25	23	32	32	32	163	59	62
	REPAIR REQUIREMENT			133	152	169	166	175	51	58	65
	NRFI ON HAND (UNFUNDED)		1								
	CARCASS RETURN FORECAST		38	20	36	36	36	36	36	36	36
	PRODUCTION QUANTITY			~~18~~	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11
	REPAIR COST			$5.670	$10.080	$10,080	$10.080	$10,080	$10,080	$10,080	$10,080
	CARCASS CONSTRAINT			128	134	141	146	169	21	26	38
	ESTIMATED BUY QTY			131			22			21	

	1ST QUARTER			2ND QUARTER			3RD QUARTER			4TH QUARTER		
	UNITS	M/H	DOLLARS	UNITS	M/H	DOLLARS	UNITS	M/H	DOLLARS	UNITS	M/H	DOLLARS
LEVEL I	0		$0	0		$0	0		$0	0		$0
LEVEL II	9		$2,835	32		$10,080	32		$10,080	32		$10,080
LEVEL III	9		$2,835	0		$0	0		$0	0		$0
LEVEL IV	0		$0	0		$0	0		$0	0		$0
TOTALS	18		$5,670	32		$10,080	32		$10,080	32		$10,080

	UNITS	M/H	DOLLARS
1ST YEAR	114		$35,910
2ND YEAR	128		$40,320
3RD YEAR	128		$40,320
4TH YEAR	128		$40,320
5TH YEAR	119		$37,485

DOP	2ND QUARTER: M/H	QUANTITY	3RD QUARTER: M/H	QUANTITY
N66664A		11 ~~32~~		32

11-11-11-11

level 2 →

IMS SIGNATURE, SECTION HEAD BRANCH HEAD DIVISION HEAD GROUP HEAD - CO

Figure 3.8 SPCC Repair Workload Forecast.

be asked to generate a tape of all DLRs that have experienced any activity in the last two years. Using the data tape from UADPS, DATAPOINT generates a workload sorted by DOP and develops the workload forecast selecting only those DLRs that have due-in or on-hand quantities at the DSP.

E. ADMINISTRATIVE TIME

Administrative time is the time required to process funding documents at the shipyard and to order and receive a carcass to be repaired. Its two main components are documentation preparation time and induction time. Figure 3.9 is a diagram of the actions that must be accomplished during the administrative time. Documentation time, the induction process and induction time will be discussed separately because the DOP is responsible for the documentation time and induction process while the DSP is responsible for the induction time.

To measure the administrative time at DOPs, sample data was collected at both a "non-automated" and "automated shipyard". The non-automated shipyard prepares documents manually, with the exception of the COAR. Using the Customer Order Documentation System (CODS) mentioned earlier, all shipyards have now automated preparation of the COAR. The automated shipyard, Long Beach, uses ARMIS. Table IV is a summary of document preparation and induction times at the two shipyards; shipyard 1 is non-automated, shipyard 2 uses ARMIS.

1. Documentation Time

The ARMIS system has reduced documentation preparation time significantly at the automated shipyard. The time required to process the documentation necessary to make repairs using ARMIS was only one sixth the time required by the manual system. This reduction in time is due primarily to two factors; (1) the RMO organization discussed earlier and (2) the fact that ARMIS has automated many of the

A = Receipt of funding document
B = Production Controller verifies NSN, funds, and quantity
C = Comptroller establishes COAR in SYMIS
D = Production controller sets up record/file of repairs
E = Production controller writes WES
F = P&E write WCD/JO
G = Scheduling
H = Key punch authorized man-hours in SYMIS
I = WCD/JO sent to local printing for duplication and distribution
J = Request for induction sent to DSP
K = DSP pulls carcass and ships to DSP
L = Receipt of carcass in MCC/RRC

```
A B   C   D   E        F         G H&I  J        K        L
|---|---|---|---|------------|--|---|--|--------------|

|<---DOCUMENT PREPARATION TIME---->|<INDUCTION TIME>|

|<--------------ADMINISTRATIVE TIME---------------->|
```

Figure 3.9 Elements of Administrative Time.

functions that must be performed manually at the non-automated shipyard. A detailed discussion of ARMIS is provided at the end of this chapter.

2. Induction Time

The difference in induction times is attributed to the responsiveness of the related DSP. Even though DOP 1 has implemented the UR-22[6] induction program, which automatically generates inductions at the DSP as part of the DSP's UADPS-SP, the DSP serving DOP 1 takes twice as long to move carcasses to the DOP. The UR-22 program uses a CRT terminal located in the shipyard which gives the PC direct access to UDAPS-SP to make inductions. Therefore, the induction time

---

[6] The UR-22 program was develop by FMSO in 1983 and installed at DOP 1 in early 1984. The system was designed to work at all DSPs, but to date has only been installed at one. [Ref. 16]

TABLE IV

DOP ADMINISTRATIVE TIMES

DOCUMENT PREPARATION TIME

DOP	NUMBER IN SAMPLE	TOTAL DOCUMENT PREPARATION TIME	AVERAGE TIME
1	48	2886 days	60 days
2	410	4112 days	10 days

INDUCTION TIME

DOP	NUMBER IN SAMPLE	TOTAL INDUCTION TIME	AVERAGE TIME
1	78	1194 days	15 days
2	3465	23653 days	7 days

TOTAL AVERAGE ADMINISTRATIVE TIME

DOP	
1	75 days*
2	17 days

* When carcasses are available this figure may be as low as 60 days.

recorded for DOP 1 consists entirely of the time it takes the DSP to pull the carcass from storage and ship it to the DOP. Using the ARMIS system DOP 2 automatically generates induction sheets which must be hand carried to the DSP. Implementing the UR-22 program at DOP 2 is expected to reduce RTAT by at least one day.

Some shipyards have coordinated their actions with the supporting DSP to reduce the impact of induction time on RTAT. Working together, the DOPs and DSPs have allocated personnel and facilities to pre-stage carcasses at or near the DOP. Additionally, the DSPs supporting these shipyards normally send representatives to the workload conferences. Then just prior to receiving the official funding document an advance copy is given to the DSP representative and all carcasses that are available are moved to DSP location near the shipyard.

3. Induction Process

The induction processes used by the various shipyards also affects RTAT. Three of the shipyards visited use the UADPS-SP UR-17 report to monitor DLRs flowing between the DOP and DSP. The fourth DOP does not use the UR-17 because the DSP has elected not to generate this report. The UR-17 report contains such information as: number of carcasses available at the DSP, condition codes, time and quantity inducted, shipped, received and completed. For the shipyards without ARMIS, the UR-17 is the only report that provides the data necessary to compute induction times used to schedule both manning and repair of the DLRs. The program also produces punched cards that act as signature receipts, are used to TIR the DLRs from "F" (failed) to "M"(in repair) condition and from "M" to "A" (meets OEM specs.) or "G" (awaiting parts) condition. The report also shows when a DLR has been stored and is available for the IM to issue.

At the DSP that doesn't use the UR-17 the DOP has no visibility of the carcasses available for induction. The DOP must call and have each item checked to see if it is available for induction. Additionally, this DOP must manually prepare two DD 1348 forms for each induction. This is very time consuming. A review of induction notices that were waiting to have 1348s typed revealed one that had been sitting in the typist's in-basket for over three months [Ref. 18].

Another aspect of the induction process that has a significant impact on RTAT is the timing of the induction request. The DOP that is currently using the UR-22 program normally makes an induction request when the estimate sheets are prepared by the PC [Ref. 8]. By making inductions in this manner many of the carcasses arrive at the DOP before the administrative loop can produce the WCD/JO. As mentioned earlier, if signature control of carcasses delivered to the shipyard is not used and the shop is not aware of the repair requirement, the carcass may not be matched to the WCD/JO. This practice may be contributing to the number of carcasses reported not received.

For DOPs with relatively small DLR workloads, making inductions shortly after the funding documents have been received is satisfactory, provided the shop or MCC is aware of the repair requirement and is expecting the carcasses. For the larger DOPs, inductions must be scheduled throughout the quarter tc maintain level manning in the RRCs.

Another constraint may be that the shop does not have the space to store three months' worth of work. Consequently, carcasses must be scheduled and inducted throughout the quarter they are workloaded.

Based on SPCC's definition of depot RTAT, that the repair clock starts when funding and the carcasses are available, DOPs are forced into artificially high administrative times. For example, if 3 carcasses are available when the funding document is received but, due to scheduling constraints, the DOP can only work one carcass a month, the carcasses scheduled for the last two months will have RTATs which are at least 30 to 60 days longer than is true. If quarterly forecasting of RTAT's continues, then RTATs computed by SPCC will remain high for the larger DOPs. By automating the workloading so that it occurs on a weekly or monthly basis using B08, ARMIS and DATAPOINT, the average value RTAT as measured by SPCC would be reduced.

F. PIECE PART SUPPORT AND REPAIR-IN-PROCESS TIME

Repair-in-process time (RIPT), as defined in this thesis, is the time from receipt of a carcass in the DOP to the time the carcass has been repaired and returned to the DSP in "A" condition. In this section, piece part support will be considered as a primary influence on reducing RIPT.

1. Measuring RIPT

Prior to looking at how RIPT can be reduced it is helpful to understand how SPCC measures RIPT. Like RTAT, SPCC measures RIPT by NSN, cog and depot type (organic and commercial). The RIPT seen by SPCC is a composite of several DOPs' efforts to repair that particular NSN. By measuring RIPT in this manner SPCC can not isolate which DOPs are performing within the desired RIPTs for any particular NSN or cog and which are not.

Because the SPCC data do not accurately reflect RIPT, samples were taken from two DOPs to determine realistic values for an automated and non-automated depot. The results of these samples are presented in Tables V and VI and have been aggregated by Federal Supply Classification (FSC).[7] The repair-in-process time shown in the two tables does not include induction, P&P and storage time. The sample for Table V included 328 different 7H NSNs. This DOP does very well in repairing selected FSCs. Of the 328 NSNs completed 60 were from five FSCs. These five FSCs represented 1277 of the 1639 units completed or 78 percent. These included only 61 NSNs or 18 percent of all NSN's repaired by the depot. This group of FSCs had an average repair in-process time of only 10.5 days. The remaining 268 NSNs correspond to only 362 completions and have an average repair-in-process time of 52.5 days.

---

[7] The FSC is the first four digits of the NSN and represents the family group and class of the DLR. For instance, the FSC for diesel engines is 2815.

TABLE V

NON-AUTOMATED DOP
REPAIR IN PROCESS TIME

FSC	NSNs	TOTAL RIPT	UNITS COMP.	AVE. RIPT
1220	2	516	74	17.9 days
5845	39	8292	462	3.8 days *
5865	16	3097	161	19.0 days
6140	1	428	269	1.6 days **
6630	3	1172	311	3.8 days *
BALANCE	268	19006	362	52.5 days
TOTALS	328	32509	1639	19.9 days

* DLRs repaired in transducer repair facility.
** NSN 6140-00-635-1398, Battery Jars.

Table VI provides a complete picture of the RIPTs for the DLRs repaired by the Electronic/Electrical RRC at Long Beach NSY and was generated by ARMIS in less than thirty minutes (it took several hours of sorting data by hand to generate Table V using the UR-17 report for the non-automated DOP).

There are several points that can be gleaned from the information in Tables V and VI.

1. DLRs that are workloaded and repaired in large volumes can support a production line operation and will reduce RIPT.
2. DLRs that are workloaded infrequently and in small numbers will have higher RIPTs.
3. Aggregate measures of RIPT can be easily distorted by a relatively few NSNs that are repaired in large quantities.

2. Piece Parts

Piece parts are those components used to repair a carcass. These components can be consumable in nature (ie. screws, bolts, gaskets, washers, etc.) or other repairables.

Normally, piece parts are ordered by P&E when the job orders are prepared. Piece parts may also be ordered by shop planners or mechanics as new requirements are

TABLE VI

AUTOMATED DOP
REPAIR IN PROCESS TIME

FSC	UNITS COMPLETED	AVE. RIPT
1075	11	52 days
1240	1	154 days
1250	12	43 days
1285	14	43 days
3950	229	40 days
4140	169	95 days
4310	28	149 days
4320	2	18 days
5355	1	83 days
5805	332	29 days
5825	38	24 days
5830	2	94 days
5840	1047	39 days
5845	8	27 days
5915	33	11 days
5930	18	49 days
5955	14	38 days
5965	1	46 days
5985	46	265 days
5990	16	53 days
5999	99	36 days
6105	189	109 days
6110	733	35 days
6115	1	379 days
6125	54	165 days
6130	34	61 days
6230	6	92 days
6320	79	4 days
6350	50	61 days
6605	1180	50 days
6625	115	21 days
6650	29	114 days
6660	2	77 days
6675	30	51 days
6680	52	43 days
6685	41	47 days
TOTAL	4716	50 days

identified when the carcass is disassembled. A third source of repair parts is shop stores. The impact of shop stores on the repairables program has been discussed earlier.

Until recently piece part initial provisioning for the depot level for major weapons systems and associated DLR subassemblies has taken a back seat in the acquisition process. When funding was tight most project managers opted to reduce support functions instead of reducing the number of systems purchased. This practice resulted in fleet comments such as, "it takes 5 DDGs to keep 3 operating".

In the mid 1970s the surface community recognized the benefits of modular repairs and began designing and provisioning ships accordingly. The FFG-7 Class "Lo-Mix" and Spruance Class destroyers were designed for modular repairs. By replacing DLRs before they broke, the ships could be kept in operation longer and would require fewer major overhauls. This was also one of the first class of ships where the DLRs were provisioned to the DOP level. Recognizing the importance of provisioning to the depot level and supporting the logistics pipeline should improve RIPT in the long run.

But what can be done in the short run? Piece part requirements are also driven by forecasted DLR requirements. The importance of accurate forecasting was addressed earlier with respect to dedicating personnel and facilities at the DOP's. The same arguments apply to stocking and ordering piece parts. However, shipyards can not afford to stock piece parts for repairing carcasses that don't materalize. As Navy Industrial Fund activities, organic depots are paid only for the work that is performed for the customer. Any advance ordering of piece parts to repair carcasses that may or may not materalize must be absorbed in the NIF corpus. Given the accuracy of the forecast, it is understandable why the DOPs are hesitant to invest in piece part support for the repairables program. One shipyard is so skeptical of the forecast that it doesn't order piece parts until the carcass has been received and torn down. If the accuracy of the forecast and timing can be improved DOPs would have no reason not to pre-order piece parts.

In addition to the accuracy of the forecast, DOPs are also concerned about the extent of cannibalization of the carcasses. [Ref. 7]. Often carcasses are missing major sub-assemblies when they are inducted. A good example is Main Feed Pump (MFP) rotating assemblies. When a MFP rotating assembly is turned in by an operating unit, the carcass should be composed of a housing, the shaft, impellers, and various smaller component parts. More often than not one or more of the impellers are missing.

One of the reasons impellers are cannibalized is the scarcity of impellers that meet OEM specification. The mechanics on board ships are aware of this problem and will retain the impellers as operating spares. The lack of quality impellers in the supply system,[8] has also lengthened the RIPT for the MFPs. Several MFP rotating assemblies have been in the repair process in excess of two years awaiting impellers that meet OEM specifications. The supply system has provided two shipments of impellers all of which were unacceptable. Each MFP rotating assembly requires four impellers at a cost of $2,400.00 each.

In the last couple of years, SPCC and the DOPs have developed procedures to help identify those activities that have cannibalize carcasses. When the DOP reports a cannibalized carcass to SPCC the turn-in activity will be charge the standard price for a replacement if they do not return the cannibalized parts. Although this procedure is available, it is not fully utilized by all the DOPs.

Quality control of repair parts purchased by the supply system has been a recurring problem. Normally, repair parts are purchased based on form, fit and function criteria. If the part looks like what it is supposed to be the part is accepted. In most cases inspecting for form, fit and function is acceptable because it would be cost prohibitive to inspect the thousands of parts the supply system purchases each day. However, for those parts that have Defective Material Reports (DMR) written, it may be wise to inspect the next batch of parts that the vendor produces. This has not been the case in the past. Another option is to put inspection criteria in the contracts for those parts that that have two or more DMRs submitted in a year. To resolve the quality problem with MFP rotating assembly impellers, SPCC has agreed to purchase the impellers from the OEM.

---

[8] The supply system as used in this context refers to parts purchased by both Navy ICPs and the Defense Logistic Agency.

To illustrate the impact of cannibalization and quality of piece parts on RTAT, RTAT was computed for two MFP rotating assemblies. Three Byron Jackson rotating assemblies (NSN 7H 4320-00-884-8202) repaired prior to 1981 had an average RTAT of 117 days. During this time frame there were no problems with the impellers. Beginning in 1982, when quality and cannibalization became a problem, the average RTAT for eight Byron Jackson rotating assemblies increased to 575 days. For twenty eight Worthington MFP rotating assemblies (NSN 7H 4320-00-667-0085) completed prior to 1982, RTAT averaged 133 days. When quality impellers became a problem, RTAT for the forty eight Worthington rotating assemblies completed since 1982 has averaged 431 days. [Ref. 19]

Several shipyards have taken initiative to improve piece part support. At two of the shipyards visited, P&E personnel have develop lists of piece part requirements for DLRs they routinely repair. These lists have been loaded on WANG computers and automatically generate job material list (JMLs) for those items that are open purchased.[9] At Long Beach NSY the program has been expanded and includes an interface with SYMIS. This program generates MILSTRIP requisitions which are passed via AUTODIN to the supporting

---

[9] Open purchases are for items that do not have NSNs assigned and must be procured from a commercial source.

DSP for piece parts that have NSNs assigned. At Long Beach the RRC shop planners also maintain a file in ARMIS which contains items that should be stocked in shop stores to support DLR repairs.

Table II of this chapter listed RTATs for both 7G and 7H COG DLRs. The majority of the DLRs that had excessive RTATs require a large number of piece parts or have parts that are difficult tc manufacture or procure. If the DOP has the capability and capacity to manufacture these parts, SPCC should provide the DOP with separate funding and allow the DOP to make the parts in volume. If the capability does not exist at the DOP, the DOP should provide SPCC with a list of the parts that have been difficult to procure. SPCC can then procure the parts at the wholesale level. This list should be in addition to the list of parts creating a "G" condition for an item in repair, which is provided with the monthly refit reports. That list only provides those parts which need to be expedited because they have delayed repair of a DLR by at least 20 days. It does not consider future repairs.

Manufacturing Resource Planning (MRP) has been installed at one DOP to provide material for selected DLRs [Ref. 17]. Based on forecasted DLR repair requirements the MRP system pre-orders piece parts using lead times and frequency of replacement to have the correct parts available when the DLR is inducted for repair. Appendix C provides a brief description of the MRP system currently in use at Long Beach. To date this system has only been used to order parts for two types of DLRs, both of which are managed by NAVSEA. These are MSO diesel engines and sealed hydrolic transmissions used on auxiliary type ships (AFS, AO, AE). At the present time this system has not proven to be cost effective and should not be exported to other shipyards in its present configuration. Efforts are continuing to improve the MRP application and, in the long run, this type of system may prove to be applicable to industrial repairs.

The NARFs are installing an MRP system under the Automated Storage, Kitting and Retrieval System (ASKARS)/Workload Planning concept, which is more sophisticated than this shipyard system. An important feature of that system is that the local DSP will be responsible for stocking the piece parts needed by the DOP. NARF Alameda is the prototype for this new system developed by SPS Corporation and NSC Oakland is its DSP.

An alternative to MRP is to modify the existing Material Requirements (MR) program. Some modifications have already been made to the MR program in SYMIS to accumulate piece part usage on DLRs. MR was originally designed to retain usage history on ship overhauls, but has been modified at Long Beach NSY to retain a history of the piece parts used on DLR. The history is retained by COAR and NSN. This was one of the reason Long Beach NSY converted from establishing a COAR per funding document to using a COAR for each line item of the funding document. Although this requires a little extra work on the part of the comptroller department, it has reduced the workload of the PCs. It also precludes the PC from manipulating the funds between line items and encourages more accurate charging by the shop mechanic. As DLRs are completed the usage data is added to previously completed DLRs.

When the MRP program was first started, work on the local MR program was halted. The local MR program works in its present form but is not being fully utilize and still needs some minor changes to be fully effective. With a few changes and a concerted effort by the DOP this program could be integrated with ARMIS and provide a basis for determining piece part requirements of DLRs. Appendix D contains a description and samples of the information the local MR program provides.

Charleston NSY is also developing a similar MR program that will maintain an automated data base containing historical JMLs and material order/usage data from previous ship availabilities as well as ordering data for current and future availabilities. This system could also be modified and incorporate the historical data on piece parts used to repair DLRs. A functional description of the capabilities of this new program is available at Charleston NSY (Code 229).

Several of the shipyards have complained that the requisition and receipt procedure that must be followed to requisition and receive piece parts takes too long [Ref. 12, 13]. Requisition and receipt process time is the time from the original identification of the requirement (written JML) until the part is actually received by the shop mechanic.

One shipyard performed an analysis of requisition and receipt process time. The sample consisted of 26 requisitions for NSN material used to repair a DLR. The shipyard measured the following times:

1. The time required for the requisition to be prepared and processed through the shipyard's requisition process to the supplier of the material. All requisitions were for NSN material. The average time was 30 days.
2. The time required by the stock point to process the requisition and ship the material to the DOP. The average time was 9 days.
3. The time required for the DOP to process the receipt and notify the shop the material was available for pick up. The average time was 31 days.

Figure 3.10 and 3.11 are flow charts of the steps involved in ordering and receiving material at this DOP. Similar steps must be performed at other DOP. Figure 3.12 is a summary of the times involved to complete each step.

It includes the shortest, longest and average times. Under the most optimistic circumstances the minimum requisition and receipt time is 28 days. It should be noted that this DOP orders material using a "D" usage code[10]

The sample verifies that a problem exist with the methods employed to process requisitions and receive repair parts. Interviews with supply department personnel indicated that during the period of time the sample was taken the SYMIS computer was experiencing considerable down time and may have contributed to the excessive times reported. When SYMIS is down material can not be ordered or received. SYMIS generates the documentation, such as material movement orders, that must accompany the material as it moves from location to location. Only in emergencies will material be ordered, received or moved without paper work. [Ref. 20]

The study offered several possible solutions [Ref. 21].

1. Order piece parts for DLRs with an "E" use code. This would eliminate the time required to stow material in DMI.
2. Increase staffing in both order processing and receipt areas.
3. Develop a program to modify critical coding.[11]
4. Restrict the use of critical coding to priority 1 or 2 and "G" condition material.

---

[10] "D" usage codes indicate the material should be placed in Direct Material Inventory (DMI) for use on a specific job. "E" coded requisitions, which the majority of the shipyards use for DLR repair parts, indicates the material should be sent directly to the shop that initiated the requisition.

[11] For requisitions that are critical coded an automatic notification is sent via CRT to the shop that originated the requisition when the item is received.

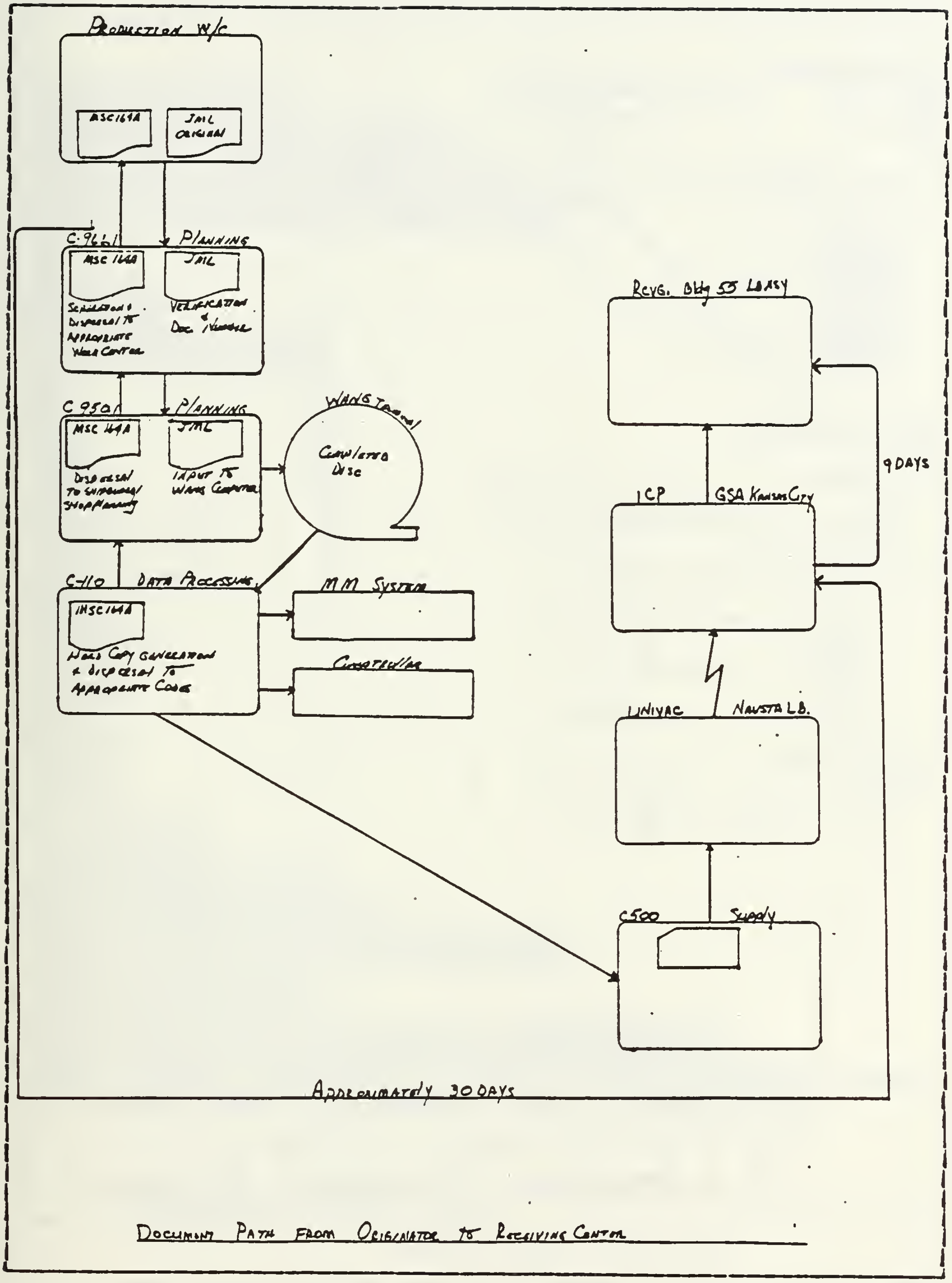


Figure 3.10 DOP Requisition Process.

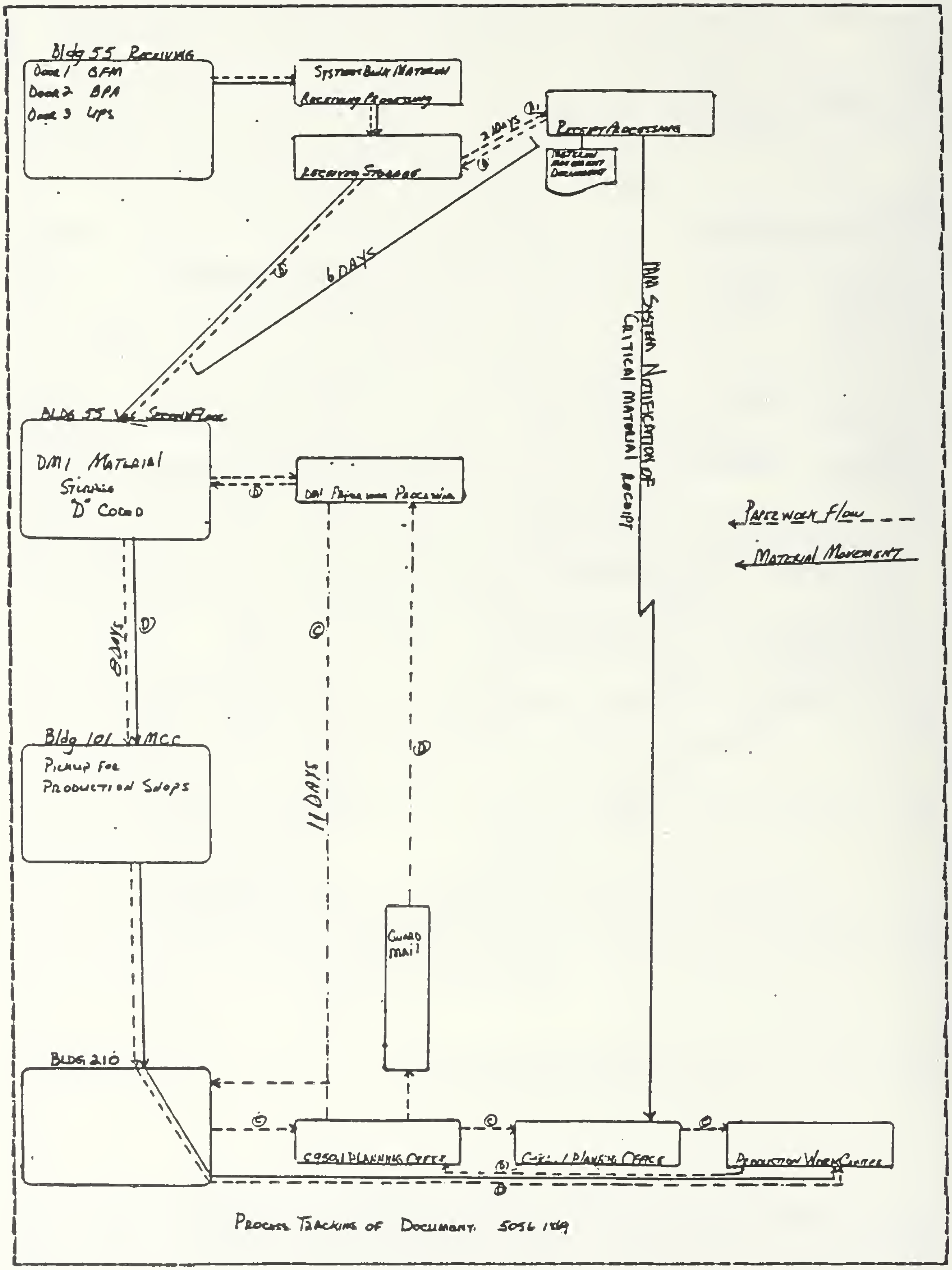
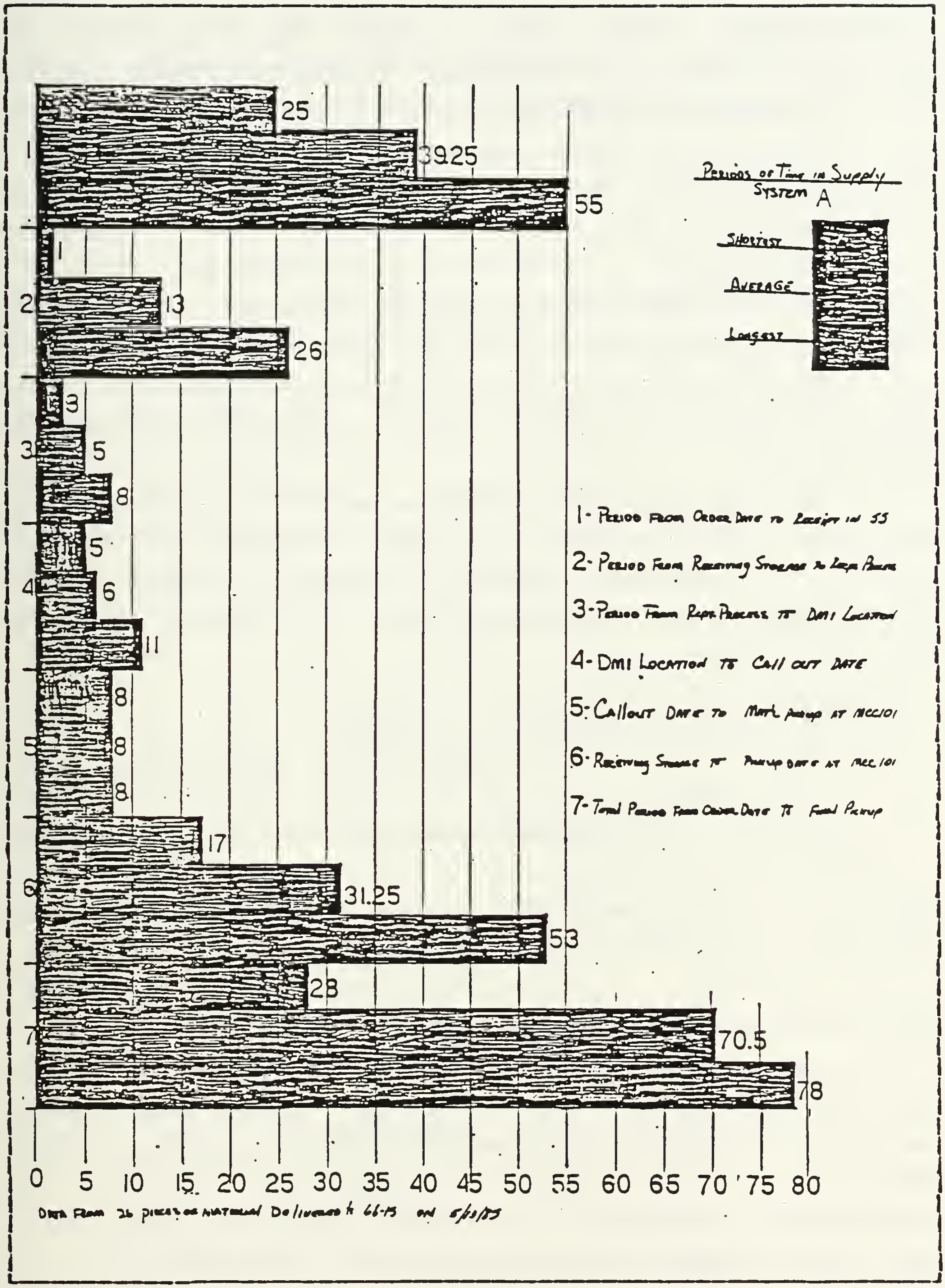


Figure 3.11 DOP Receipt Process.



Data From 26 pieces of material Delivered to 66-15 on 5/30/85

Figure 3.12 Requisition and Receipt Times.

5. Develop minimum time frames for non-receipt of material and automatically upgrade the requisition to critical and begin expediting action as soon as these minimums have been exceeded.
6. Update the material requirements list of P&E personnel and pre-order material when funding is received.

These solutions may reduce the time it takes to order and receive material at this DOP. However, several of the shipyards visited use the "E" usage codes and still complain that order and receipt times are excessive. [Ref. 14, 7]

A more effective solution would be to modify or streamline the procedures employed to order and receive material. This would require modifying portions of the SYMIS as well as shipyard procedures and is beyond the scope of this thesis.

G. PRESERVATION, PACKAGING AND STORAGE

SPCC's position concerning P&P is that because the repair funds that are provided to repair a DLR includes P&P, it is the DOP's responsibility to monitor and take actions to reduce P&P time [Ref. 22]. With the exception of one DOP visited, P&P is accomplished by the DSP. Normally, each shipyard will issue a funding document to the DSP to perform the P&P function. P&P involves protecting and boxing the DLR for storage and eventual shipment to the end user.

Currently there is no uniform way to accurately measure how long a DLR spends in P&P at either a DSP or DOP. It is possible to measure the P&P and storage times at those activities that use the UR-17 program and where the DSP performs both functions. If P&P is accomplished by the DOP this time is pooled with the repair-in-process time. If it is done by the DSP the time is included with the stow time. The ARMIS is capable of monitoring this time but doesn't because the DSP performs the P&P function where ARMIS is used. Storage under both definitions is still counted as part of the DOP's RTAT even though the DOP has no control over this segment.

By measuring the difference in the time the ZUB (report of receipt of an "A" condition DLR) and the ZUD (report of storage) transactions are processed, storage time could be calculated. At two of the DSPs, the repairables clerk maintains manual records on P&P and storage times. According to these individuals, P&P and storage times average six to seven days [Ref. 23, 24]. One DSP is currently in the process of developing a UADPS-SP program to capture this time. When developed, it should provide both SPCC and the DSPs with information on what the actual times are. SPCC does not currently monitor this time [Ref. 9].

SPCC's definition of RTAT includes P&P and storage times even though the DOP has little or no control over these segments. When these times are combined with the induction time, the total represents a significant portion of RTAT that a DOP has no control over.

H. AUTOMATED REPAIRABLES MANAGEMENT SYSTEM (ARMIS)

One of the major problems faced by all concerned in trying to reduce RTAT is the problem of converting the data in SYMIS and the UICP computer systems into meaningful management information.

As previously discussed in this chapter the ARMIS system has been in use at one DOP for over three years and has proven to be an efficient and cost effective method of reducing RTAT. The system has also proven to be an effective management information system. The system is very flexible and has the potential to reduce RTAT even further.

The ARMIS system was develop and implemented at Long Beach NSY in 1983 to support the growing repairables program. When Long Beach was designated the DOP for over two hundred DLRs to be used on "LO-MIX" FFG-7 Class ships in the Class Maintenance Plan, it was anticipated that the repairable effort would grow from approximately five percent to as large as twenty percent of the shipyard workload [Ref. 17].

ARMIS uses a relational data base[12] computer system to store and manipulate data into meaningful information as well as to generate many of the forms and reports needed to manage the program. The system is extremely "user friendly" and requires very little training or programing knowledge to use effectively. The system manager was previously a shop planner and only required two weeks of training to perform effectively in the system manager role. In addition, with only two weeks training a manager or technician can also learn to write programs and extract information tailored to his or her needs.

The primary objectives of ARMIS are:

1. Accurate and expeditious generation of monthly reports supplied to customers and for in-house management functions. Information is updated daily using magnetic tape interfaces between SYMIS and ARMIS. Monthly reports are up-to-date and contain all the information required by NAVMAT's Navy Repairables Management Manual.
2. Automated control and monitoring of the life cycle of DLRs from the receipt of a funding document through the final billing process. Appendix E contains a description of the information and data flow within ARMIS from receipt of a funding document to final billing.

---

[12] A relational data based computer systems allows the user to retrieve, sort and manipulate data from several files at one time.

3. Provide a catalog of all DLRs overhauled by the shipyard in a central file with easy access.
4. Automatically generate work estimate sheets, log sheets, induction sheets as well as management reports and listings. Appendix F contains samples of these sheets reports and listings.
5. Interface with the Customer Order Documentation System (CODS) and SYMIS. CODS generates a COAR for each DLR using standard information about the DLR, such as NSN, nomenclature, man-hours authorized, repair price, customer, and stabilized rates.
6. Retain a history of completed DLRs at the COAR and NSN level.
7. Monitor repair performance at the shop, work center and foreman level.
8. Automated forecasting of quarterly workloading requirements at the shop and work center level.

The standard information is maintained in ARMIS and updates CODS on a weekly basis via magnetic tape. ARMIS receives cost data from SYMIS, also via magnetic tape. This allows real time information retrieval. For example, much of the statistical information used in this thesis was generated by ARMIS. Data can be sorted and a report generated in a matter of minutes. Figure 3.13 shows the relationship and interfaces of the RMO, RRC, CODS and SYMIS.

To assist in workloading ARMIS uses the hours required to repair a DLR. By matching the workloaded hours with the man-hours available in the shops and work centers, shop planners can determine if the forecasted workload is adequate to support the number of personnel assigned to that shop. If not, ARMIS can generate a list of DLRs that will give the required workload. This list is passed to the IM for review and action.

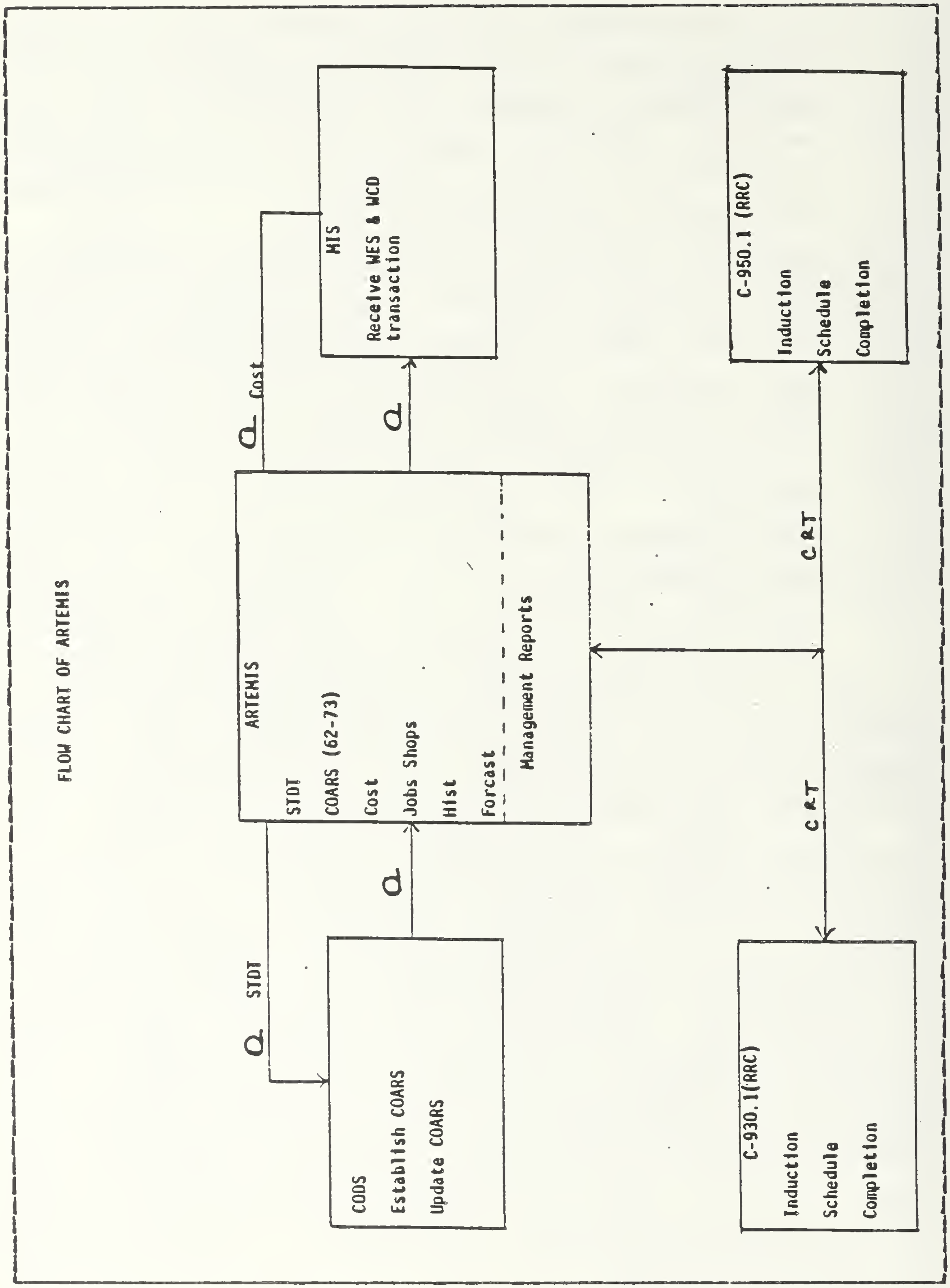


Figure 3.13 RMO, RRC, CODS and SYMIS Interface.

As noted in references used throughout this thesis many of the problems associated with excessively long RTATs can be attributed to the lack of an automated repairables system that provides information and meets the needs of the managers. The ARMIS currently in use at Long Beach has eliminated many of these problems for one DOP. The system is owned by the Navy and can be exported with only minor changes to the software.

On a larger scale, ARMIS could be used in a network composed of organic DOPs, NAVSEA and SPCC. By allowing the customers inquiry access into the files at the various DOPs the need for monthly reports could be eliminated. As mentioned in the forecasting section, ARMIS could also be used to automate the workload by interfacing with the SPCC DATAPOINT system.

ARMIS could be modified to receive weekly tapes from SPCC and automate the workload in much the same manner as ASO and the NARFs have done [Ref. 6]. Long Beach NSY has requested a quarterly workload tape in the past, but has not receive one to date. A tape interface between ARMIS and the B08 on a bi-weekly or monthly basis would eliminate the need to rely on due-in quantities to set up DOP workload. As carcasses are received at the DSP they could be workloaded to the appropriate DOP.

From a telephone conversation with Metier Management Systems, Inc. (the developers of ARTEMIS)[13] they estimate ARMIS could be implemented at other DOPs at a cost of $230,225.00 per DOP. The necessary training is estimated to be $40,000.00 for all DOPs. Metier is also willing to develop a "custom" course designed to specifically meet the needs of ARMIS users. Appendix G is a copy of the Metier's response to a request for estimates on hardware and training cost.

---

[13] ARTEMIS is the trade name for a scheduling system develop by Metier, Inc.. The scheduling application of ARTEMIS is currently being installed at all shipyards. ARMIS uses the same system with the scheduling function disconnected.

Many of the recommendations made in this section are ambitious but they are also realistic and can be accomplished with NAVSEA's support and financial backing. A major factor in reducing RTAT is to provide the DOP with a computer system that is flexible and meets the user's needs.

I. SUMMARY

This chapter has attempted to provide a detailed look at the key issues that affect RTAT. Forecasting and the DOP repair process have been examined to identify problems and develop alternatives that, if implemented, may reduce RTAT. These alternatives will form the basis for the recommendation and conclusions outlined in the next chapter. The problems outlined in this chapter should not be viewed as all inclusive but as significant issues that must be addressed if RTAT is to be reduced.

IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The DOP repair cycle is a complicated process that requires numerous interfaces between various organizations, computer systems and people. As a carcass is moved through the repairables cycle these organizations, computer systems and people must coordinate their actions and ideas if they are to significantly reduce repair turn around time (RTAT).

At present, most shipyards are not organized to support the Naval Supply Systems Command's (NAVSUP) RTAT new goal of 60 days. In fact, the analysis contained in this thesis indicates that more than fifty percent of the DLRs repaired at naval shipyards exceeds 60 days and that only approximately 65 percent of the DLRs completed meet the old NAVSUP goal of 90 days. If RTAT for all DLRs can be reduced to 60 days the Navy may realize savings amounting to more than 180 million dollars.

The thesis has examined each step in the DOP repair cycle to determine if the RTAT of DLRs managed by SPCC can be reduced.

Chapter II provides the reader with a general overview of the repair cycle as well as a feel for the complexities involved in managing the repair of DLRs. It provided a brief description of how SPCC determines the quarterly repair requirements and workloads the shipyards. A detailed description of the steps and procedures the shipyard must follow to complete the repair of a DLR was also provided.

Chapter III attempted to provide a detailed look at the key issues in each segment of the depot repair cycle that has increased RTAT and explored possible alternatives that can reduce RTAT. The impact of workload forecasting on the DOPs' repairables policies and procedures was also examined. The specific areas examined in Chapter III included:

- Institutional Issues
- Depot Organization
- Workload Forecasting
- Administrative Time
- Induction Time and Process
- Effects of Piece Parts on Repair in Process Time
- Preservation, Packaging and Storage

B. CONCLUSIONS AND RECOMMENDATIONS

These conclusions and recommendations are based on the analyses in Chapter III of current practices and procedures associated with the DLR repair cycle. Recommendations are offered of possible actions to take to reduce RTAT for DLRs repaired at naval shipyards to achieve the new SPCC goal of 60 days.

1. Institutional Issues

Before any progress can be made to reduce RTAT to 60 days several institutional issues must be resolved.

a. Filler Work

To date NAVSEA and the shipyard commanders have viewed the repair of DLRs as "filler work". Thus, the single most important action that can be taken to reduce RTAT is for both to support the repairables efforts, by insuring dedicated personnel are hired and trained specifically for repairing DLRs.

b. RTAT Subdivision

Based on conversations with personnel directly involved in the repairables programs at the shipyards there seems to be a great deal of confusion on the definition of the repair time SPCC is trying to reduce to 60 days. The confusion arises from the various definitions promulgated by SPCC and CNM.

For example, currently , SPCC measures RTAT at the DOP level as the time from when the DOP receives a funding document and a carcass is available, to the time the carcass has completed the repair process and is stored at the DSP. This SPCC definition assumes the DOP is responsible for induction, preservation, packaging and storage times. CNM's definition of depot RTAT included induction time but did not include preservation, packaging and storage time. Even so, both definitions include functions normally performed by the DSP. Most DOPs have no control over how long it takes the DSP to perform these functions.

Therefore, RTAT should be divided into well defined segments with responsibilities and goals assigned to each by agreement between NAVSEA and SPCC. The DOPs should be responsible for:

- Administrative time. This is the time from receipt of a funding document to the time an induction request is submitted to the DSP or the Work Control Document / Job Order is delivered to the shop, which ever is later.
- Repair in Process Time. This is the time from when the shop receives a carcass in "F" condition until the carcass is returned to the DSP in "A" condition, exclusive of "G" condition time. Carcasses which are surveyed or mis-identified should not be counted.

The DSP should be responsible for the induction time, which occurs after the administrative activities and before the repair-in-process can begin. The DSP should also be responsible for the time associated with preservation, packaging and storage because these functions occur after the DOP has returned the repaired DLR to the DSP.

By dividing RTAT into these segments the managers at SPCC, the DSP and the DOP can concentrate on those segments for which they have control.

c. "G" Condition Delays

NAVSUP's policy of having carcasses returned to the DSP for storage and the cancelling of outstanding requisitions for repair parts when a carcass is placed in "G" condition has caused many of the DOPs not to use "G" condition for larger DLRs. Consequently, RTAT appears longer than it should be.

DOPs and DSPs should be allowed and encouraged to make local arrangements for the storage of the larger DLRs at the DOP when repair of the item is delayed due to the lack of repair parts. It is not normally cost effective to gather all the removed components, reassemble the item, and transport it to the DSP. The policy requiring the DOP to cancel outstanding requisitions and have the DSP reorder the material is inefficiant and time consuming, leading to larger RTATs.

2. DOP ORGANIZATION

The primary mission of naval shipyards has been to provide logistic support for the construction, conversion, overhaul, repair, alteration and drydocking of U. S. Navy ships and service craft. Consequently, shipyards tend not to be organized to support a repairables program.

To provide such support requires a centralized authority and responsibility to effectively and efficiently manage the repairables program. NAVSEA has already authorized and approved a Repairables Management Organization (RMO) at Long Beach NSY. NAVSEA has also approved the Repairables Rework Centers at two shipyards (Long Beach and Norfolk NSYs). The RMO and RRC concepts have proven they can reduce RTAT. These concepts should be expanded to all shipyards that perform a DOP function.

3. Workload Forecasting

SPCC's workload forecasting drives many of the policies and procedures used by the shipyards. Based on forecasted workloads, DOPs plan manning and repair parts requirements to support the repairs of DLRs. Due to the inaccuracies of these workload forecasts the DOPs have been hesitant to dedicate personnel and facilities to support the repairables programs. In addition, the DOPs are hesitant to order piece parts in advance using the NIF corpus funds because they are concerned the parts will not be used.

SPCC should attempt to improve the accuracy and consistency of the workload forecasts. Efforts should also be made to automate the workload scheduling. SPCC's DATAPOINT computer system is used to generate the quarterly DLR workload for each DOP. The Automated Repairables Management Information System (ARMIS), currently in use at Long Beach NSY, is capable of accepting a magnetic tape from DATAPOINT with only minor program changes. An interface between the Shipyard's Management Information System (SYMIS) and DATAPOINT is possible but would be difficult to program and do very little to reduce RTAT. The shipyard MIS is designed to manage the overhaul of ships where ARMIS is designed to support a repairables program.

4. ADMINISTRATIVE TIME

Administrative time is the time required to process funding documents at the shipyard. This time includes preparation of all the documents necessary to induct a carcass for repair. This time tends to be excessive at most DOPs. In some cases, the time to manually prepare the documentation necessary to repair a carcass exceeds 60 days.

As a consequence of developing ARMIS Long Beach NSY has been able to reduce administrative time to less than one week because ARMIS automatically generates many of the forms and reports needed to manage the program efficiently. Interfaces between ARMIS, SYMIS and the Customer Order Documentation System (CODS) have also been developed. Additionally, ARMIS provides meaningful management information upon request. This system is extremely flexible and should be exported to other DOPs. Only minor programing changes would be needed. It is also "user friendly" and most changes could be made with as little as two weeks training.

ARMIS can also compute the times for each segment of the DOP repair cycle.

5. Induction Time and Processes

Induction time is the time it takes the DSP to deliver a carcass to the DOP. The process by which the DOP makes inductions as well as the time it takes for the DSP to move the carcass to the DOP typically adds at least one week and often two weeks to RTAT.

The recently developed automated induction program (UR-22), which is part of the Stock Point's Uniform Automated Data Processing System (UADPS-SP), is in use at Mare Island NSY. This program has reduced inductions times at that DOP and could do the same at other DOPs. The UR-22 program should be made available to all DOPs. However, because the UR-22 program is part of UADPS-SP, the DSP must initiate a request to Fleet Material Support Office, Mechanicsburg, Pa. to have it installed [Ref. 16]. NAVSUP should encourage the DSPs to use the UR-22 program to reduce RTAT as well as speed the induction process for the DOP.

At some DOPs and DSPs, losing carcasses after an induction request has been made has delayed repairs. Signature control should be used to monitor the movement of carcasses between the DOP and DSP.

All DSPs should also send representatives to the bi-annual workload conferences. This would foster good working relationships between the DOP and DSP as well as allow the DSP personnel to take an active role with SPCC in solving the problems associated with inductions, preservation, packaging and storage. By obtaining advance copies of the workload forecast, DSPs should pre-stage carcasses at or near the DOP and communicate with SPCC about shortages.

6. Piece Parts and Repair-in-Process Time (RIPT)

The lack of required repair parts from both the Navy's supply system and the shipyard's supply departments and, in some cases, the poor quality of the parts that are supplied have resulted in excessive RIPT. Historically, the lack of initial provisioning of piece parts for new major weapons systems to the depot level has caused many of these problems. Today, the Department of Defense is requiring that more emphasis be placed on logistics support of new weapons system procurements. This should improve the availability of piece parts in the long run.

Quality control of repair parts purchased by the Navy's supply system has also been a recurring problem. For example, the repairs of some Main Feed Pump rotating assemblies have been delayed over two years waiting for the supply system to procure acceptable repair parts. For parts that have Defective Material Reports submitted, the Inventory Control Points should impose quality standards in the procurement contracts and ensure the vendor meets those standards prior to accepting the parts. Accepting repair parts based on form, fit and function criteria is unacceptable when quality problems have been identified.

Several of the DOPs complained that their requisitioning and receipt processing times take too long. At one shipyard, a sample of 26 requisitions for repair parts stocked in the Supply System revealed that it took an average of 69 days for a technician to order and receive the part. To correct this problem, the procedures used to order and receive material at the DOPs needs to be streamlined.

Additionally, DOPs' shop stores do not carry many of the repair parts needed in the repairables programs. When lists of material are provided to shop store managers by production workers, an effort should be made to carry those repair parts that meet shop stores criteria.

Two shipyards, Long Beach and Charleston, have expanded the Material Requirements (MR) programs in the SYMIS to capture piece parts usage on past ships' availabilities. Long Beach has modified this program to also include piece parts usage history on DLRs. Using this information a

DOP can more accurately determine which repair parts and in what quantity are needed to repair a carcass. A cross-fertilization of ideas between Charleston and Long Beach NSYs should be encouraged on this effort and when de-bugged, these programs should be made available to all DOPs.

7. Preservation, Packaging and Storage

SPCC's position is that preservation and packaging is the DOPs' responsibility because they are funded to accomplish these functions. Usually, however, the DSP performs these activities. As a consequence, preservation, packaging and storage should not be included as part of the DOP repair time because the DOP has no control over how long the DSP takes to perform these functions. In addition, although the DOP is funded to provide the preservation and packaging function it is not cost effective to duplicate the facilities that exist at the DSP.

Preservation, packaging and storage should be assigned to the DSP and should be measured separately. SPCC, in particular, should develop a method to monitor this segment of the repair cycle to quantify the impact on RTAT. Finally, efforts to reduce the time required to perform these functions should be directed to the appropriate DSP.

APPENDIX A

SPCC WORKLOAD FORMS

DCP: N65884A

QUARTERLY WORKLOAD FORECAST

FY: 1984 QUARTER: 1
PAGE: 1

COG NSN ITEM NAME PART/DRAWING NO. SYSTEM(S)	LRC	1. MANHOURS 2. RTAT 3. SURVIVAL RATE 4. REPAIR COST		REPAIR DUES	QTY	QTR 1	QTR 2	QTR 3	QTR 4	TOTAL	EXTENDED COST	REMARKS:
7G2C 6625-00-0041142 TEST SET SUBASSEMBL 138242 E0288046 EP UJD AN/UFM-137A, TEST SE	P2S	1. 2. 1.00 3. 0.05 4. $140				0	0			0	$297	AIR FORCE ITEM
7G 5820-00-0047007 CIRCUIT CARD ASSEMB A70732-001 AN/URT-23	PM1	1. 8. 2. 0.20 3. 0.57 4. $300	 $655			0	1	0	1	2	$600	
7G1C 5895-00-0055425 CIRCUIT CARD ASSEMB 1732-1845 IP-1030/U, DATA DISP	PNS	1. 24 2. 2.00 3. 0.05 4. $840	 200 400	NWPN3558000000	1	2	1	1	1	5	$4,246	
7G1C 5805-00-0055430 POWER SUPPLY SUBASS 1732-2165 CV-2772/U, CONVERTER CV-2772(XG-1)/U, CON CV-2771/U, CONVERTER	PNS	1. 24 2. 0.40 3. 0.07 4. $800	 250 60	NWPN3550000001	1		1	0	1	3	$2,594	
7G2A 5890-00-0055441 CIRCUIT CARD ASSEMB 1735-3038 C-9585(XG-1)/U, CONT C-9585/U, CONTROL-IN	PNS	1. 12 2. 1.77 3. 0.05 4. ~~$704~~	324 200 200 724	NWSN3581030062	0	3	3	3	3	10	$14,010	
7G4A 5985-00-0002031 APC, PPC, DIR COUPL 01A225003-21-11 AM-3007B/URT SNEP SH AM-3007B/URT, AMPLIF AM-3007/URT SER F1-F	PM1	1. 4 2. 0.03 3. 0.00 4. $314	 125	NWPN3551060200 NWPN3542720272	11 12	11	11	11	11	44	$13,010	Check class on PO

CONSOLIDATED STOCK STATUS REPORT (UADPS-ICP)

PAGE NUMBER	SDR DATE	HOLD DATE	WAC	TMS	ADD DATE/ REASON	FIRST DEMAND	RULES CODE P	VK	R	RS		COG	UI	REPLACEMENT UNIT PRICE	ITEM NAME	LRC	FAMILY F/GP	R/C	STOCK NUMBER			
20152	5007	00000	HD	E	72091 P	72152		4		AR			EA	$ 1254.84	APC, PPC, DIR COUPL	PM1	AAVB	H 1	7GH	5985	00	0062031

ACTIVE POPULATION AIL	PAC	MAP	OTHER	PC UOD	SPAC	SHELF LIFE	RESTRICT CODE	MGMT DATA AP DOC S	DRIPR CODE	CIO	FSCM	AIE	GROSS WEIGHT	GROSS CUBE	PACKAGE QTY	RISK	PLT	CSSR PRINT REASONS
					51	0 00	00	HD DQ U	1P			.500	2.00	.06	1	.135	5.10	99CREPW

PRIOR DISPOSAL	ACON WAR RESERVE	CONTR PROC LT MAD	RETENTION LIMIT	REPLEN PROC ACQ CD	ITEM STATUS CODE	PURCHASE XFER DT	SUPP SUPPORT LEVEL	CONTD PROD LT AVG	NEXT BUY DATE	PLT PROGRAM VALUE MAINT	OVHL	PROGRAM VALUE END LT MAINT	OVHL	MAINT PROGRAM VALUE PROC TAT	REPAIR TAT	SMIC	STANDARD UNIT PRICE
		.0	832	91	62CC	87142	NNNNN	3.									$ 1140.00

DEMAND OBSERVATION-CURRENT QUARTER MAINT	OVHL	SCHED	REQN	DEMAND FORCAST QUARTER	REQN	PROC VARIANCE	DEMAND DURING LT	HORIZON DATE M/B ALLOCATIONS	DEMAND END OF LT	MAD MAINT	OVHL	DDI MAINT	OVHL	RANDOM DEMAND AVG. MAINT	OVHL
10		1	9	38.8	33.000	8542.	197.9	●●●●●	38.8	7.0542	.0000			11.2499	.0000

CONDITION CODE A ON HAND	DUE OUT	REGENERACY ON HAND	DUE OUT	OTHER CONDITIONS ON HAND	DUE OUT	PLT DUE IN RFI	REGENERACY	PLT ASSETS	RFI REGEN DURING LT	NET SYST XCES/DEFIC	RFI REGEN END OF LT	RFI REGEN PROC TAT	RANDOM DMD REPAIR TAT	
3									172.1		33.7	32.	26	3

BACK ORDERS	MATERIALS OBLIGATIONS	PLT SCHED PPR	SAFETY LEVEL	REORDER LEVEL	REPAIR VARIANCE	ECON ORDER QTY		REPAIR LEVEL	REPAIR ORDER	REPAIR UNIT COST	WEAR OUT RATE	FSM PIC	REPAIR FUNDS CONTROL	REPARABLE IO CODE	SURVIVAL RATE MAD
15	17			165	691.	21		134	40	$ 315.00	.16	●●	HE02		.08

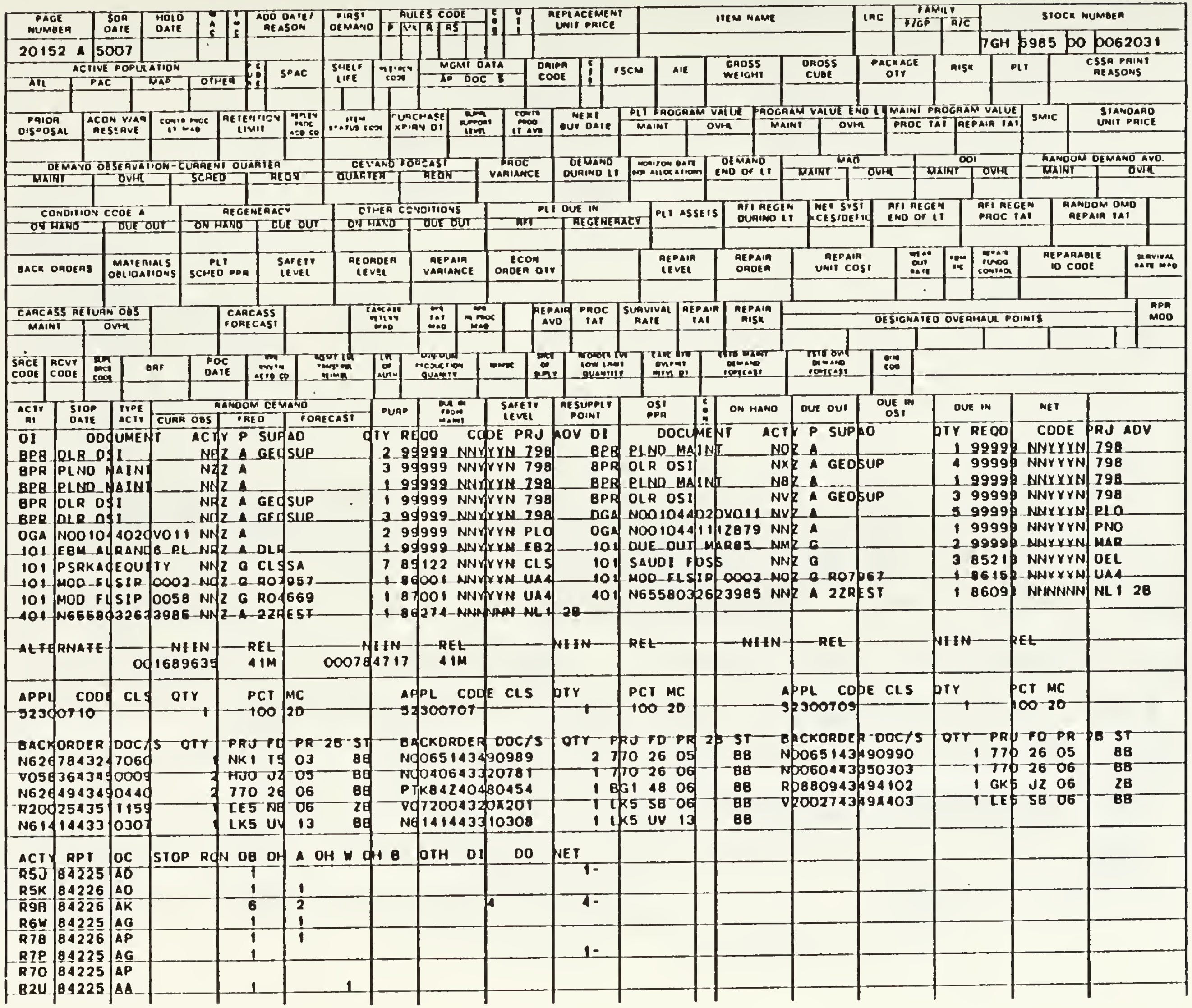
CARCASS RETURN OBS MAINT	OVHL		CARCASS FORECAST		CARCASS RETURN MAD	RPR TAT MAD	RPR IN PROC MAD		REPAIR AVG	PROC TAT	SURVIVAL RATE	REPAIR TAT	REPAIR RISK	DESIGNATED OVERHAUL POINTS						RPR MOD
1			11		6.5604	.	.3		.68	.95	.90	.67	.135							2

SRCE CODE	RCVY CODE	SM PRICE CODE	BRF	POC DATE	INV INVTR ACTG CD	MGMT LVL [illegible]	LVL OF AUTH	MINIMUM PRODUCTION QUANTITY	[illegible]	SRCE OF SUPLY	REORDER LVL LOW LIMIT QUANTITY	CARC RTN OVHL MTVL DT	ESTD MAINT DEMAND FORECAST	ESTD OVHL DEMAND FORECAST	DIM EOQ
PA	D		.1399	00000		516	22	1	V	N35	1	99365	0	0	

ACTV RI	STOP DATE	TYPE ACTV	RANDOM DEMAND CURR OBS	FREQ	FORECAST	PURP	DUE IN FROM MAINT	SAFETY LEVEL	RESUPPLY POINT	OST PPR	CON	ON HAND	DUE OUT	DUE IN OST	DUE IN	NET	
NIZ		RD			.000	A					A						
NJZ		SD			.405	A					A						
NMZ		SP			.000	A					A						
NMZ					.000	G					A						
NNZ		RD	5	4	11.300	A		15	19		A	1			5		14
NNZ						A					E						
NNZ					.000	G					A						
NRZ		RP			3.598	A		5	6		A	1			5		
NRZ						A					F						
NBZ		SD	1	1	.605	A					A						
PPZ		SD			.270	A					A						
NDZ		RD	3	3	9.112	A		12	15		A						
NDZ						A					F	1	12				
NDZ						A					M	2					
NOZ		RD	1	1	3.025	A		4	5		A						
NOZ						A					F						
NOZ					.000	G					A						
NUZ		SD			.203	A					A				1		
NXZ		SD			1.418	A					A						
NXZ						A					F						
NPZ		RD			1.403	A		2	2		A	1			1		
NVZ		RD			4.023	A		5	6		A				7		
NZZ		RD			2.313	A		3	4		A				2		

DI	DOCUMENT/CALL	CLIN	FROM	TO	QTY	CC	DELY	QTY	DATE	AF	E	PC(FR)	PC(TO)
BST	NWPN3542729272			NDZ	13		85009					A	
DDK	N0040643320781			NUZ	1		85102		84350	E	E	A	
DDK	N0060443350303			NPZ	1		85252		84348	E	E	A	
DOK	N0065143490989			NVZ	2		85277		84366	E	E	A	
DDK	N0065143490990			NVZ	1		85277		85004	E	E	A	
DDK	N6264943490440			NZZ	2		85277		84368	E	E	A	
DDS	N0010484VZ759	000	AB	NRZ	5		85179		84052	E		A	
DDS	N0010484VZ759	000	AC	NVZ	4		85179		84052	E		A	
DDS	N0010484VZ759	000	AA	NNZ	5		85179		84052	E		A	

CONSOLIDATED STOCK STATUS REPORT (UADPS-ICP)



PAGE NUMBER 20152 A

SDR DATE 5007

STOCK NUMBER 7GH 5985 00 0062031

```
ACTY STOP TYPE  RANDOM DEMAND            PURP DUE IN SAFETY RESUPPLY OST   ON HAND DUE OUT DUE IN  DUE IN  NET
RI   DATE ACTY  CURR OBS FREQ FORECAST        FROM   LEVEL  POINT    PPR                   OST
                                              MAINT
OI     ODCUMENT      ACTY P SUPAD         QTY REQD   CODE PRJ ADV DI   DOCUMENT     ACTY P SUPAO       QTY REQD   CODE PRJ ADV
BPR DLR OSI          NRZ A GEOSUP          2 99999 NNYYYN 798   BPR PLND MAINT      NOZ A              1 99999 NNYYYN 798
BPR PLNO MAINT       NZZ A                 3 99999 NNYYYN 798   BPR OLR OSI         NXZ A GEOSUP       4 99999 NNYYYN 798
BPR PLND MAINT       NNZ A                 1 99999 NNYYYN 798   BPR PLND MAINT      N8Z A              1 99999 NNYYYN 798
BPR DLR OSI          NRZ A GEOSUP          1 99999 NNYYYN 798   BPR OLR OSI         NVZ A GEOSUP       3 99999 NNYYYN 798
BPR DLR OSI          NDZ A GEOSUP          3 99999 NNYYYN 798   DGA N00104402OVO11  NVZ A              5 99999 NNYYYN PLO
OGA N001044020VO11   NNZ A                 2 99999 NNYYYN PLO   OGA N001044111Z879  NNZ A              1 99999 NNYYYN PNO
101 EBM ALRAND6 PL   NRZ A DLR             1 99999 NNYYYN EB2   101 DUE OUT MAR85   NMZ G              2 99999 NNYYYN MAR
101 PSRKAGEQUITY     NNZ G CLSSA           7 85122 NNYYYN CLS   101 SAUDI FOSS      NNZ G              3 85218 NNYYYN OEL
101 MOD FLSIP 0002   NDZ G RO7957          1 86001 NNYYYN UA4   101 MOD FLSIP 0003  NOZ G RO7967       1 86158 NNYYYN UA4
101 MOD FLSIP 0058   NNZ G RO4669          1 87001 NNYYYN UA4   401 N655803262398S  NNZ A 2ZREST       1 86098 NNNNNN NL1 2B
401 N665803262398S   NNZ A 2ZREST          1 86274 NNNNNN NL1 2B

ALTERNATE      NIIN      REL           NIIN      REL       NIIN      REL       NIIN      REL       NIIN      REL
             001689635   41M         000784717   41M

APPL     CODE CLS   QTY    PCT MC        APPL     CODE CLS  QTY    PCT MC        APPL     CODE CLS  QTY    PCT MC
52300710              1    100 2D        52300707             1    100 2D        52300709             1    100 2D

BACKORDER DOC/S   QTY  PRJ FD PR 2B ST   BACKORDER DOC/S   QTY  PRJ FD PR 2B ST   BACKORDER DOC/S   QTY  PRJ FD PR 2B ST
N62678432470G0      1  NK1 T5 03    BB   N00651434909B9      2  770 26 05    BB   N00651434909 90     1  770 26 05    BB
V05836434S0009      2  HJO JZ 05    BB   N00406433207B1      1  770 26 06    BB   N00604433S0303      1  770 26 06    BB
N62649434904 40     2  770 26 06    BB   PTK84Z40480454      1  BG1 48 06    BB   R08809434941O2      1  GK5 JZ 06    ZB
R200254351159       1  LE5 NB 06    ZB   VO72004320A201      1  LK5 SB 06    BB   V20027434944O3      1  LE5 SB 06    BB
N61414433O307       1  LK5 UV 13    BB   N61414433103O8      1  LK5 UV 13    BB

ACTY  RPT   OC  STOP RON  OB  DH  A OH W OH B  OTH  DI   DO  NET
R5J  84225  AD             1                                 1-
R5K  84226  AO             1   1
R9B  84226  AK             6   2                     4       4-
R6W  84225  AG             1   1
R78  84226  AP             1   1
R7P  84225  AG             1                                 1-
R7O  84225  AP
R2U  84225  AA             1          1
```

CONSOLIDATED STOCK STATUS REPORT (UADPS-ICP)

PAGE NUMBER	SDR DATE	HOLD DATE	[illegible]	[illegible]	ADD DATE/ REASON	FIRST DEMAND	RULES CODE P	MK	R	RS	[illegible]	[illegible]	REPLACEMENT UNIT PRICE	ITEM NAME	LRC	FAMILY F/GP	R/C	STOCK NUMBER
20152 B	5007																	7GH 5985 00 0062031

ACTIVE POPULATION ATL	PAC	MAP	OTHER	[illegible]	SPAC	SHELF LIFE	RESTRCT CODE	MGMT DATA AP	DOC	$	DRIPR CODE	[illegible]	FSCM	AIE	GROSS WEIGHT	GROSS CUBE	PACKAGE QTY	RISK	PLT	CSSR PRINT REASONS

PRIOR DISPOSAL	ACON WAR RESERVE	CONTR PROC LT MAD	RETENTION LIMIT	[illegible]	ITEM STATUS CODE	PURCHASE XPIRN DT	[illegible]	[illegible]	NEXT BUY DATE	PLT PROGRAM VALUE MAINT	OVHL	PROGRAM VALUE END LT MAINT	OVHL	MAINT PROGRAM VALUE PROC TAT	REPAIR TAT	SMIC	STANDARD UNIT PRICE

DEMAND OBSERVATION-CURRENT QUARTER MAINT	OVHL	SCHED	REQN	DEMAND FORCAST QUARTER	REQN	PROC VARIANCE	DEMAND DURING LT	[illegible]	DEMAND END OF LT	MAD MAINT	OVHL	ODI MAINT	OVHL	RANDOM DEMAND AVG MAINT	OVHL

CONDITION CODE A ON HAND	DUE OUT	REGENERACY ON HAND	DUE OUT	OTHER CONDITIONS ON HAND	DUE OUT	PLT DUE IN RFI	REGENERACY	PLT ASSETS	RFI REGEN DURING LT	NET SYST XCES/DEFIC	RFI REGEN END OF LT	RFI REGEN PROC TAT	RANDOM DMD REPAIR TAT	

BACK ORDERS	MATERIALS OBLIGATIONS	PLT SCHED PPR	SAFETY LEVEL	RECRDER LEVEL	REPAIR VARIANCE	ECON ORDER QTY		REPAIR LEVEL	REPAIR ORDER	REPAIR UNIT COST	WEAR OUT RATE	[illegible]	REPAIR FUNDS CONTROL	REPARABLE IO CODE	SURVIVAL RATE MAD

CARCASS RETURN OBS MAINT	OVHL		CARCASS FORECAST		[illegible]	[illegible]	[illegible]		REPAIR AVG	PROC TAT	SURVIVAL RATE	REPAIR TAT	REPAIR RISK	DESIGNATED OVERHAUL POINTS	RPR MOD

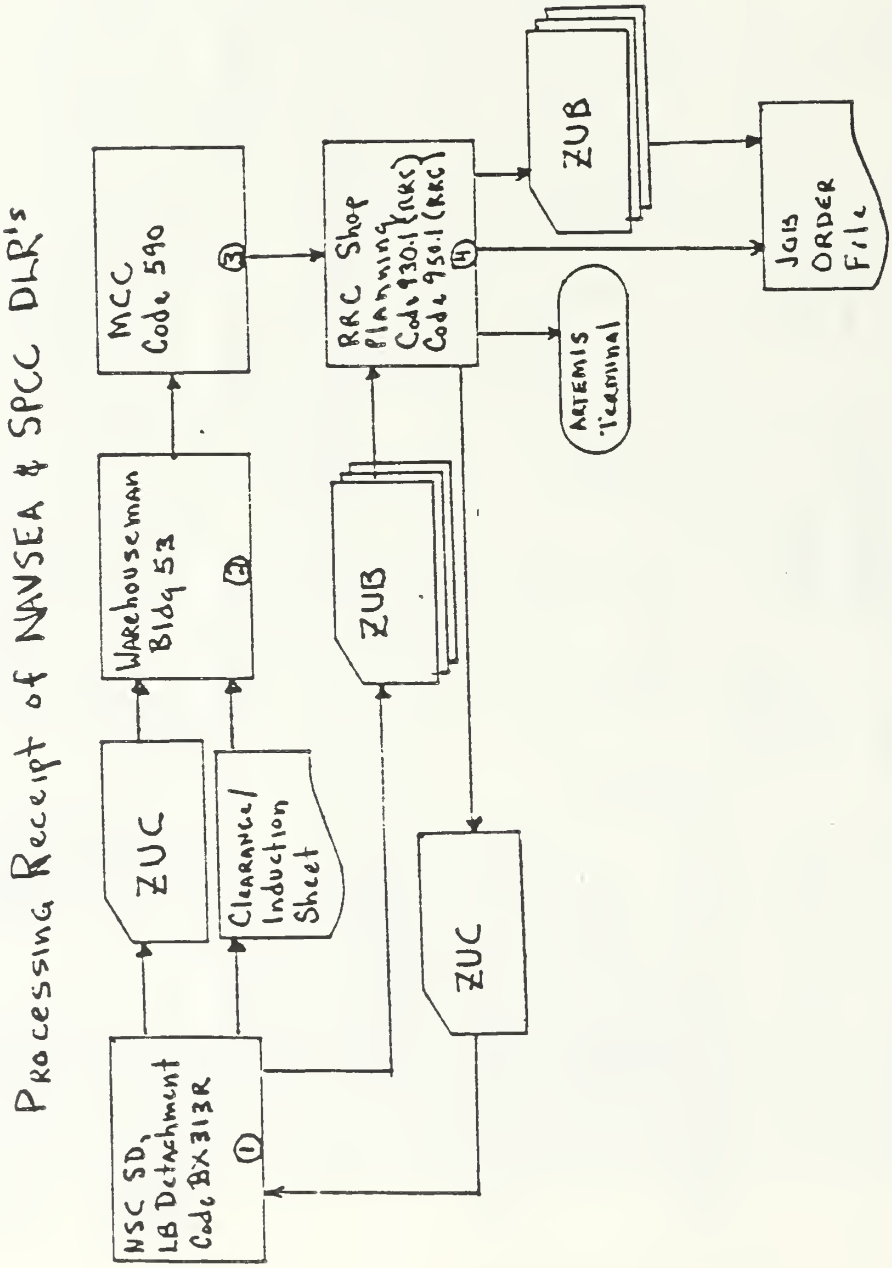
SRCE CODE	RCVE CODE	[illegible]	BRF	POC DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

ACTY RI	STOP DATE	TYPE ACTY	RANDOM DEMAND CURR OBS	FREQ	FORECAST		PURP	DUE IN FROM MAINT	SAFETY LEVEL	RESUPPLY POINT	OST PPR	[illegible]	ON HAND	DUE OUT	DUE IN OST	DUE IN	NET	
ACTY	RPT	DC	STOP RON	OB OH	A OH	W OH	B	OTH DI	DO	NET								
R2V	84226	AJ		5						5-								
R2W	84225	AA		1					1	1-								
R2X	84225	AJ		1						1-								
R3D	84226	AJ		1						1-								
R3F	84225	AA		1						1-								
R3H	84225	AA		1						1-								
R4K	84004	AF		1		1												
R4N	83258	AN		1		1												
R4U	84225	AF		1						1-								
R4X	84226	AN		1		1												
R4Y	84226	AN		1		1												
R4P	84020	AF		1						1-								
R9F	84225	AK		8	1					7								
R9H	84225	AK			1					1								
R9J	84225	AB		4						4-								
R9K	84225	AB		5						5-								
R9N	84226	AK		5	2					3-								
GRAND TOTALS:				50	9	5			5	38-								

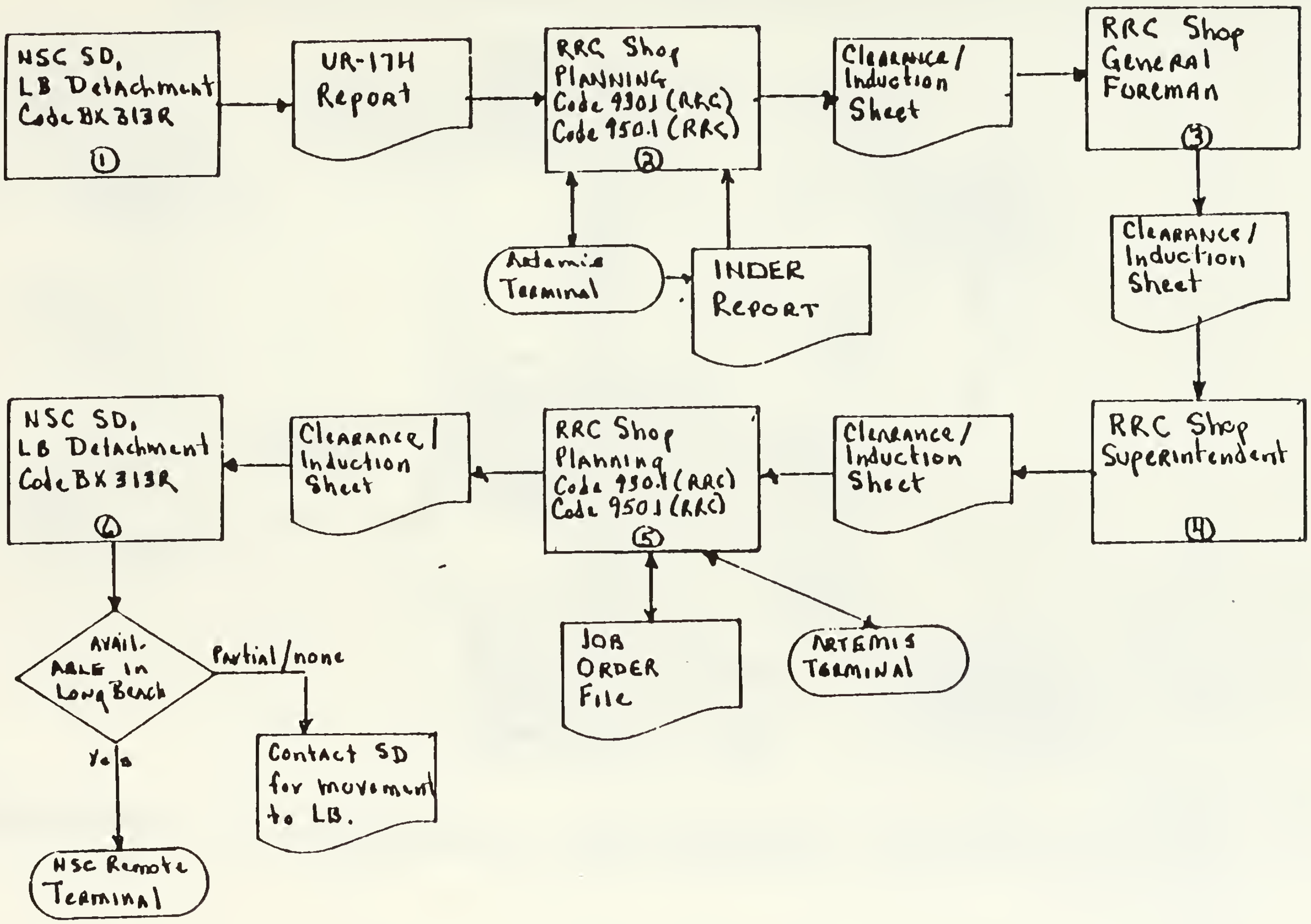
```
                                              SPCC REPAIR WORKLOAD FORECAST
                                              -----------------------------

COG       NSN          SMIC  LRC  FGC   REL   EXTRACT DATE: 84353           STANDARD PRICE:          $1,140.00
---  ---------------   ----  ---  ----  ---
7G4A 5985-00-0062031         PM1  AAVB   0    CURRENT DATE: 84357           REPLACEMENT PRICE:       $1,254.84

     ITEM NAME: APC, PPC, DIR COUPL     EQUIPMENT NAME: AM-3007B/URT, AMPLIF    NET PRICE:                 $501.00
                                                        S2300709  EP UJ7
                                                        AM-3007/URT SER F1-F    REPAIR PRICE:              $315.00

     PLT:    5.10     REQ. FREQ.:         32.000     REORDER LEVEL:     112     SR:  0.90       CRF:   35.9
     RTAT:   0.62     DEMAND:             38.810     REPAIR LEVEL:       86     M/H:

                                          OPENING
                                          POSITION    1Q   |  2Q      3Q      4Q      5Q   |  6Q      7Q      8Q
                                          --------  ------ | ------  ------  ------  ------ | ------  ------  ------
REQUIREMENTS: IG 1 BOs, OOs - CASREPTS  I
------------- ALL OTHER BOs - OOs       II        4       4      55      74      81      88      97
              999 PPRs                  II       30      30
              DEMAND X RTAT             III      39      39
              DEMAND                    III      39.             39      39      39      39      39      39      39
              ALL OTHER PPRs - PWRs     III               7       3                       2
              REPAIR SAFETY LEVEL       IV       39      39      39      39      39      39      39      39      39
              ECONOMIC REPAIR QUANTITY  IV       39      39      39      39      39      39      39      39      39
                                              ------  ------  ------  ------  ------  ------  ------  ------  ------
                 TOTAL REQUIREMENTS                     158     175     191     198     207     214     117     117

ASSETS:       ON HAND                             4       4                                              27      20
-------       DUE IN (ODS/A2_) BY QTR             3       3      23      32      32      32     163      32      32
              FUNDED REPAIR (BS1/ODS*)           18      18
                                              ------  ------  ------  ------  ------  ------  ------  ------  ------
                 TOTAL ASSETS                            25      23      32      32      32     183      59      52

                 REPAIR REQUIREMENT                     133     152     159     168     175      51      58      65
              NRFI ON HAND (UNFUNDED)             1
              CARCASS RETURN FORECAST            36      20      38      36      38      36      36      36      36
                 PRODUCTION QUANTITY                 ~~18~~  ~~32~~ 11  ~~32~~ 11  ~~32~~ 11  ~~32~~ 11  ~~32~~ 11  ~~32~~ 11  ~~32~~ 11

              REPAIR COST                            $5,670 $10.080 $10.080 $10.080 $10.080 $10.080 $10.080 $10,080
              CARCASS CONSTRAINT                        128     134     141     148     159      21      28      36
              ESTIMATED BUY QTY                         131                      22                      21

                   1ST QUARTER                     2ND QUARTER                  3RD QUARTER                  4TH QUARTER
             UNITS    M/H     DOLLARS       UNITS     M/H     DOLLARS      UNITS     M/H     DOLLARS      UNITS     M/H     DOLLARS

LEVEL I        0                  $0          0                  $0          0                  $0          0                  $0
LEVEL II       9              $2,835         32             $10,080         32             $10,080         32             $10,080
LEVEL III      9              $2,835          0                  $0          0                  $0          0                  $0
LEVEL IV       0                  $0          0                  $0          0                  $0          0                  $0
             ------  ------  ----------    ------  ------  ----------    ------  ------  ----------    ------  ------  ----------
TOTALS        18              $5,670         32             $10,080         32             $10,080         32             $10,080

             UNITS    M/H     DOLLARS                OOP     2ND QUARTER:  M/H     QUANTITY    3RD QUARTER:  M/H     QUANTITY
             ------  ------  ----------            ------                ------    --------                ------    --------
1ST YEAR      114            $35,910               N65584A                         11 ~~32~~                              32
2ND YEAR      128            $40,320                     11-11-11-11
3RD YEAR      128            $40,320
4TH YEAR      128            $40,320             level 2 ⟶
5TH YEAR      119            $37,485

     IMS SIGNATURE,          SECTION HEAD        BRANCH HEAD        DIVISION HEAD        GROUP HEAD - CO
```

APPENDIX B

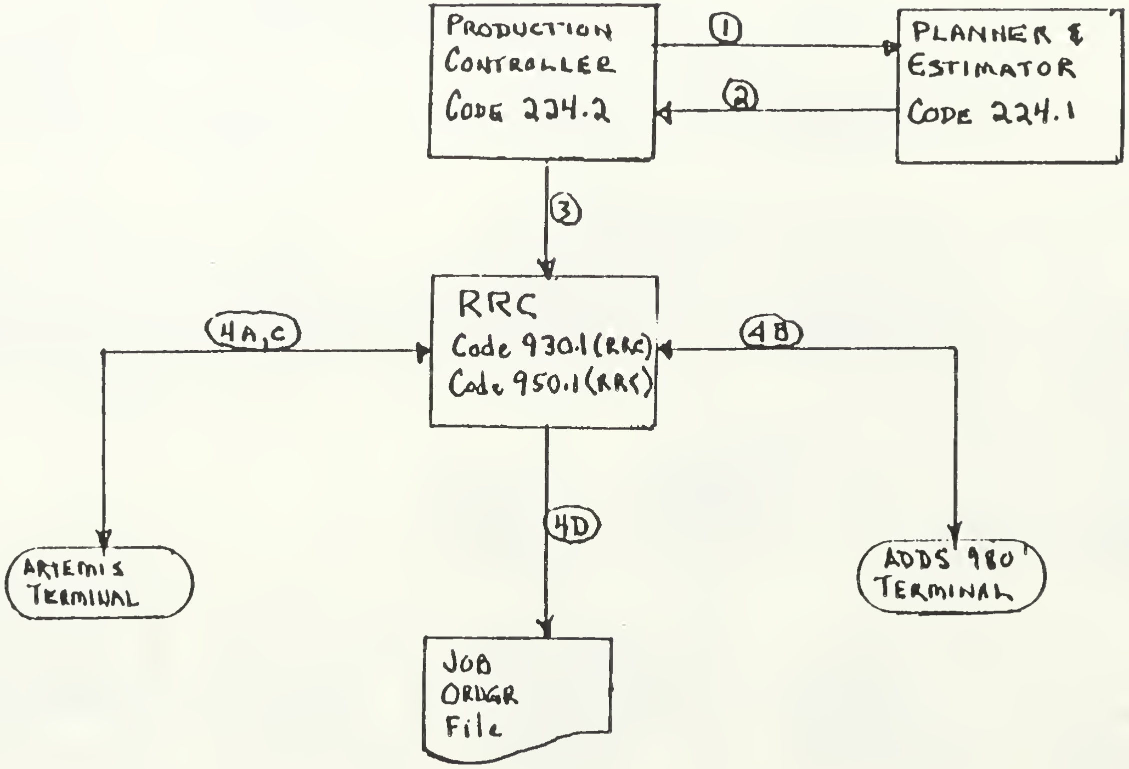
RRC FUNCTIONAL FLOW CHARTS


Processing Receipt of NAVSEA & SPCC DLR's
NSC SD, LB Detachment Code BX313R ①
ZUC
Clearance/ Induction Sheet
Warehouseman Bldg 53 ②
ZUB
ZUC
MCC Code 590 ③
RRC Shop Planning Code 930.1 (RRC) Code 950.1 (RRC) ④
ARTEMIS Terminal
ZUB
Jais ORDER File

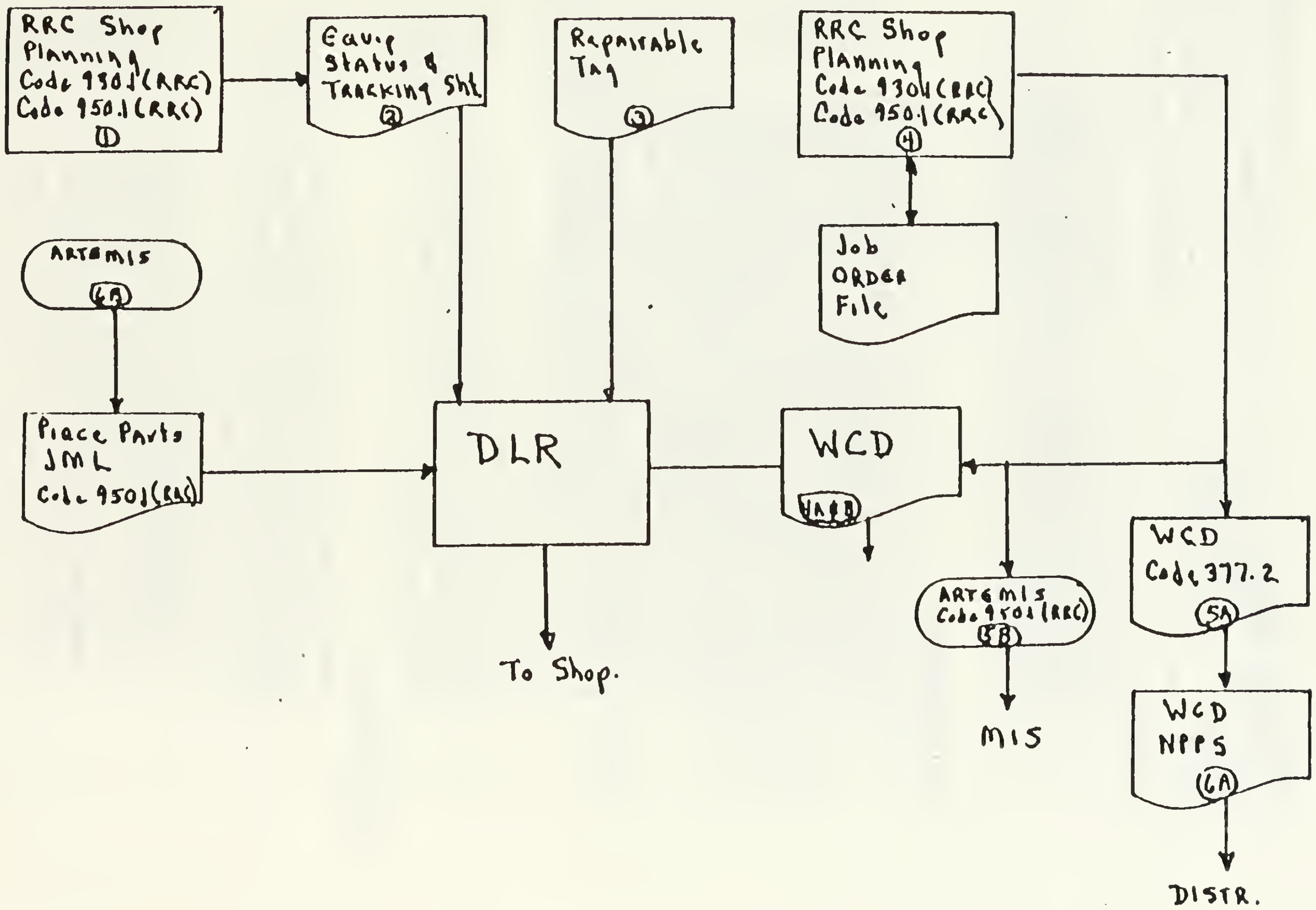
Processing of Inductions for SPCC DLR's


NSC SD, LB Detachment Code BX 313R ①
UR-17H Report
RRC Shop Planning Code 930.1 (RRC) Code 950.1 (RRC) ②
Clearance/ Induction Sheet
RRC Shop General Foreman ③
Artemis Terminal
INDER Report
Clearance/ Induction Sheet
RRC Shop Superintendent ④
Clearance/ Induction Sheet
RRC Shop Planning Code 930.1 (RRC) Code 950.1 (RRC) ⑤
Clearance/ Induction Sheet
NSC SD, LB Detachment Code BX 313R ⑥
Job Order File
Artemis Terminal
Available in Long Beach
Partial/none
Contact SD for movement to LB.
Yes
NSC Remote Terminal

PROCESSING OF INFORMATION WORK CONTROL DOCUMENT (WCD)



PROCESSING ISSUANCE OF WORK CONTROL DOCUMENT


RRC Shop Planning Code 930J(RRC) Code 950.1(RRC) ①
Equip Status & Tracking Sht ②
Repairable Tag ③
RRC Shop Planning Code 930J(RRC) Code 950.1(RRC) ④
Job ORDER File
ARTEMIS 6A
Place Parts JML Code 950J(RRC)
DLR
To Shop.
WCD 4A&B
ARTEMIS Code 950J(RRC) 5B
MIS
WCD Code 377.2 5A
WCD NPPS 6A
DISTR.

APPENDIX C

LONG BEACH NSY MRP SYSTEM DESCRIPTION

USER PROCEDURE MANUAL

DATE	SECTION NAME	SECTION	PAGE
04/18/83	MRP OVERVIEW	1.1	1 of 2

Objective:

The objective of Manufacturing Requirements Planning (MRP) is to plan and control material for the repairables program. The system is a timely, accurate, easy to use, shop-oriented tool for managing material used in the overhaul of major repairable components.

Closed Loop Concept:

The Closed-Loop Manufacturing Resource Planning (MRP) system is a proven, comprehensive planning and control system for resources (material, labor, and facilities) required to meet the overall business objectives of the Shipyard. This closed-loop system for the Long Beach Naval Shipyard (LBNS) begins with the planning activity. This includes determining which components are to be overhauled at LBNS, by quarter, and then developing a more detailed Master Production Schedule of when each overhaul is to be performed for the overhaul's within the nearest quarter. The term "Closed-Loop" means that there is timely feedback between the execution and planning functions, which will ensure proper actions are taken when changes in the Master Production Schedule occur. For example, if a job order cannot be completed on time, this information is fed back to the Master Production Schedule so that adjustments to scheduled due dates of other overhauls can be made and the proper management action taken.

Once the planning phase is complete and the Master Production Schedule has been tested and is attainable, the execution activities begin. The execution activities include detailed planning, ordering, and monitoring of each job order and its material requirements.

System Functions:

The MRP system performs a broad range of important material planning and control functions. These functions have been logically grouped into different application modules. The material-related MAC-PAC modules, which are implemented at the Shipyard, are briefly described below:

(1) Design Engineering - This module maintains the Part Master File and the Product Structure (Bill of Material) File. The Part Master File identifies each part number in the system and describes how it is controlled in the storeroom. The Product Structure File defines the bill of material for each major repairable component. This product structure lists the materials, by part number and quantity, required to perform each class of overhaul on each major repairable component.

Name: MRP OVERVIEW (continued)

(2) Inventory Control - This module monitors the status of each part number in the system. It tracks not only the quantity on-hand in the storeroom, but also the quantity on-order (requisition or manufacturing order) and when the on-order quantity is due from the vendor or the producing shop. This module also tracks the detailed issue status of each job order, by part.

(3) Requirements Planning - This module has two primary functions. First, it maintains a Master Production Schedule of Shipyard repairs for the next year or two. This Master Production Schedule shows the anticipated repair schedule for each class of overhaul on each type of component, by day. Second, this module processes the Master Schedule against the bills of material to determine the materials needed to satisfy the Master Production Schedule. Using material requirements planning techniques, it reserves materials already on-hand and on-order. The module then identifies any additional materials required to complete the scheduled work and determines when to order, how much to order, and when the materials ordered should be received in the storeroom.

Other MRP modules, which maintain operation routings and plan and monitor labor and material on the shop floor and develop standard costs and monitor actual versus standard costs, are also available.

The Design Engineering module is used to develop and maintain the material specifications required to support MRP. This module maintains the Part Master File and the Product Structure File. The Part Master File identifies each stock number in the system and describes how it is processed within MRP. The Product Structure File defines the bill of material for each major repairable component controlled by MRP by stock number and the quantity required to perform each class of overhaul on each type of component. The main objectives of Design Engineering are:

(1) To develop and maintain accurate product structure information for repairable items.

(2) To develop and maintain part information.

(3) To minimize production costs through effective control of product engineering changes and part-related data.

The Design Engineering module supports these objectives by:

(1) Providing organization and maintenance of product structure data for each overhaul (the Product Structure File is a structured list of materials and the quantities of each part required to perform a given class of overhaul).

(2) Maintaining, for each item, the part master data pertaining to planning, purchasing, inventory, and production control. All part order policies, including lead times, and part usage policies are maintained on the Part Master File through the use of the Design Engineering module.

PART MASTER FILE

The MRP Part Master File is a list of all parts processed by MRP within a shop. This includes all DMI and shop store material. A part cannot be ordered, received, issued, or overhauled unless it exists in the MRP Part Master File.

The stock number is used to uniquely define each part on the Part Master File. The following key information is maintained in addition to the stock number of the part.

(1) Reference. Reference information identifies the type of part and includes a description of the part for identification purposes.

(2) Order Policy. Order Policy information specifies how shop store's requisitions and JML order quantities will be calculated by Requirements Planning. Examples of order policy information are the safety stock quantity, a minimum order quantity, and a maximum order quantity.

PART MASTER FILE (continued)

(3) Lead-Time. Lead-time information specifies when the component parts analyzed by Requirements Planning should be ordered. The leadtime of some parts at the Shipyard is highly variable. The leadtime can be effected by how, where, and from whom the part will be acquired. Because of this, management attention should be directed at maintaining realistic lead-times to ensure that within a reasonable probability, material is received on time.

(4) Inventory. Inventory quantity balances provide planners, supply clerks, and shop personnel with the quantity on-hand and the quantity on-order for all parts. This includes inventory balances for shop stores and DMI material.

PRODUCT STRUCTURE FILE

The Product Structure File contains a list of material required for each overhaul class. These product structures are used by the Requirements Planning application module to determine material requirements. For planning purposes, the quantity required is calculated by multiplying the quantity of the part required for each parent times the usage frequency. For example, if two valves are components of one sealed hydraulic transmission, but they are replaced in only 50 percent of the overhauls, only one valve could be ordered for each scheduled overhaul. The quantity per parent and the usage frequency are defined for each part on the Product Structure File.

Each product structure reflects the way a major repairable component is overhauled. This is done by defining the parts belonging to each sub-assembly. This allows mechanics and planners to easily identify each part while performing an overhaul.

ENGINEERING CHANGE FILE

MRP provides control over the addition of a new product structure. The Engineering Change File provides this control.

An Engineering Change Order transaction must be submitted for each new parent being input into the Product Structure File. On this transaction, the date at which Requirements Planning will begin using the product structure is specified. This date is called an effectivity date. To ensure that inaccurate data will not be used to plan material requirements, the effectivity date should first be specified as several years in the future. Doing this is termed opening an Engineering Change Order.

CROSS REFERENCE FILE

The Cross Reference File provides MRP users with a list of manufacturer's part numbers for each stock number. This file supports the needs of the shop personnel who use the manufacturer's part number (obtained from technical manuals) to identify a part.

CROSS-REFERENCE FILE (continued)

The cross reference of stock numbers allows MRP to print the manufacturer's part number on all documents used by shop personnel. Cross reference reports are available by stock number, by manufacturer's part number, and by part description. Also, cross-reference information can be obtained through on-line inquiry conversations using either the stock number or the manufacturer's part number.

JML DETAIL FILE

The JML Detail File is a list of all purchased parts processed by MRP within a shop. This includes all DMI and shop stores material. The stock number is used to uniquely define each part on the JML Detail File. Information on the JML Detail File is used by shop personnel for writing JML's.

SYSTEM CONTROLS

The MRP system provides procedural and system controls that assist users in maintaining accurate and up-to-date information. Although MRP will automatically recognize many user errors and data inconsistencies, the ultimate responsibility of accurate data rests with the users.

Following is a brief description of the controls provided by MRP.

(1) Manual Procedures. Manual procedures require the approval of input documents by key personnel before they are entered into MRP.

(2) Batching Controls. Batching controls verify that all transactions were processed.

(3) Terminal Sign-on Procedures. Terminal sign-on procedures control access to the MRP system at the transaction level to prevent unauthorized entry of data.

(4) Input Validation. Input validation verifies that invalid data does not corrupt the MRP data base. For example, if a field has predefined values, MRP will allow only the correct values of the field to be entered.

(5) Detailed Audit Trails. Detailed audit trails document all changes to the MRP Master Files for user verifications.

(6) Error Recycling. Error recycling ensures that all transactions that are rejected by MRP are corrected and processed properly.

(7) Master File and Run-to-Run Control. Master File and run-to-run controls notify system operators when program errors occur and when system errors occur.

(8) Data Base Audit Reporting. Data Base Audit Reporting verifies that existing data on the Part Master File is complete.

The Inventory Planning and Control Module monitors the status of each part in MRP. Ensuring accurate inventory balances by controlling the movement and usage of material within the Shipyard is critical to MRP. The primary objectives are:

(1) Reduce the amount of working capital tied up in inventories.

(2) Increase overhaul efficiency, through improved control over material availability.

(3) Minimize costly write-offs due to inventory obsolescence.

The Inventory Control module supports these objectives by defining and processing all the transactions necessary for control of on-hand and on-order balances. Stock status and repair and requisition order status reports highlight shortage, surplus, past-due, and obsolete inventory conditions.

Within the Inventory Control application, shop paperwork is also prepared. This paperwork identifies the status of component requirements maintained for each job order. The reporting provides an indication of component availability and a measure of part substitution and part usage variances.

IP&C Functions

Master Production Schedule:

Planners use various quarterly schedules to develop a Master Production Schedule which identifies the week in which the components will be overhauled. A preliminary Master Production Schedule is determined by weighing available labor and machine resources against the workload. Once this Master Production Schedule has been approved, the components to be overhauled by period are input to the Requirements Planning function. The Master Production Schedule is the driving force for the planning activity. The Master Production Schedule for a major repairable component reflects anticipated overhauls needed, by time period, as projected by NSWSES, NAVSEA, SPCC, etc.

The forecasted quantities are entered as "advance planned" orders into the Master Production Schedule. These "advance planned" orders are exploded by MRP through the Product Structure File to calculate the gross part requirements (i.e., the total quantity of parts which are likely to be needed to perform the scheduled overhauls). The MRP system reviews the on-hand and on-order positions of each part, applies the acquisition lead times for each part, and produces time-phased net material requirements. The MRP system creates planned requisitions for parts with suggested order placement dates. When the placement date is reached, the MRP system will produce a report requesting the planner to firm the requisition in MRP and submit a JML into the MIS system. When updated forecast information is

Master Production Schedule: (continued)

received. The Master Production Schedule will be changed to reflect the revised information. MRP will then examine the affected part requirements and determine whether new supply orders are required.

Plan Material

Material planning consists of identifying parts needed, projecting the need for parts over time, and ordering parts to meet these needs.

The definition of the part is the foundation upon which material planning and control is built. Critical information is maintained about the part; such as stock number, description, part type, material planning information, on-hand and on-order quantities and part cost. Without all this information, the MRP system cannot function properly and interface with the Shipyard MIS system.

One of the most critical factors to be identified is accurate lead times. MRP uses the lead-time information to determine when to order a part to insure that it arrives at the Shipyard when it is needed. Lead times for many parts are highly variable. A lead-time reporting system will use data developed by the MRP system to compare actual lead times to current lead times on the Part Master File and suggest appropriate changes.

After a part has been defined, planning bills of material will be input into the MRP system. The planning bills of material itemize the materials that make up a major repairable component. The total quantity of each part likely to be needed in an overhaul is the total quantity in the component adjusted for the usage frequency of each part. "Usage frequency" is simply the probability, expressed as a percentage, of a part's being replaced during a repair. Usage frequency is the key to material planning since, for a given overhaul, part requirements cannot be determined with precision until the disassembly, inspection and testing are completed. Usage frequencies for each part will be based on historical usage, manufacturer's engineering estimates and estimates supplied by production work center personnel. The MRP system will maintain its own historical usage data to be used to update these initial estimates of usage frequencies.

The MRP system will capture all receipts for outstanding requisitions, of both DMI and Shop Stores material. DMI parts will be tracked into and out of Building 55 to Building 129, while Shop Stores parts will appear as being received directly by Building 129.

Process Overhaul

After a major repairable component arrives in the shop, it is first disassembled and inspected. At this time, the parts required are listed on a system created inspection report (Material Requirements/Pick List) which will be used for picking the parts in the MCC and as the source document for entering issue transactions into the MRP system. Using the quantities written on this document by the mechanic, the MRP system's planned part requirements for this component will be changed to the actual parts required for the overhaul. As the job order is completed, all issue information will be entered into the MRP system and will be retained for use in usage history analysis. Unplanned but required parts, which are not on-hand after a component is inspected, will be ordered immediately.

Usage Tracking

Usage frequency is one of the primary differences between using MRP in the ship overhaul environment versus a manufacturing environment. Unlike manufacturing, in performing overhauls, parts' requirements typically cannot be determined with precision until a component is disassembled, inspected and tested. Usage frequency provides a method for planning material in this uncertain environment.

The term "usage frequency" means the probability, expressed as a percentage, that a part within a component will be replaced during an overhaul. It does not relate to the probability that the component itself will fail or be missing.

Material planning in MRP is accomplished by developing planning bills of material for each component to be repaired. Planning bills of material contain the usage frequency of the parts in a component. Only parts that have a predictable usage frequency should be listed in the planning bills. Other parts are managed by maintaining a safety stock for the part. Planning bills are used to determine the quantity of each part in a component that will probably be needed to complete an overhaul. When components are placed in the Master Production Schedule, the Requirements Planning module of MRP uses the planning bill of material to calculate the gross material requirements. The gross requirements area netted against on-hand and on-order quantities to determine whether additional orders are necessary. This occurs months in advance of receiving the major repairable component. Suggested material orders are then offset, based on anticipated acquisition lead time. Suggested orders are reported to the appropriate planner for confirmation or denial of the placement of the order.

Usage Tracking (continued)

Once the repairable is disassembled and inspected, the actual part requirements will be determined. When these parts are issued to the job order, the part usage will be captured by the MRP system. A reason code associated with each issue will be indicated. The usage reason code will be: (1) replacement, (2) failure, or (3) missing. By tracking the usage reason, the classification will allow shop personnel to report trends for specific parts. This will be especially useful in overhauls of new components from new classes of ships.

MRP will provide a maintenance process to allow planners to adjust the usage frequency. Planners will receive information from MRP suggesting that the usage frequency of certain parts be changed (exception information based on usage history). The planners will review this information and decide which parts to update and what usage frequency value to enter. This review process will allow the planner to apply judgment and experience to override computer suggested actions when appropriate.

The usage frequency maintenance system will:

(1) Capture and retain in a historical usage file issue and job order data that accounts for all actual overhauls. This data will be detailed enough to account for actual usage by stock number, overhaul class, and model.

(2) Provide the ability to scan the historical usage file to select those items warranting special analysis because historical usage rates deviate significantly from the established (actual) usage rate.

(3) Provide the planner with "computer recommended" usage frequency based on statistical computation of historical average.

(4) Provide summary or detail information about individual part usage.

(5) Provide a reason code for usage history updates to prevent inaccurate updates to nonactive parts or to parts whose usage frequency has been overridden by planners independent of computer suggested usage values.

(6) Provide assistance in determining appropriate safety stock levels for individual or selected parts.

Order Tracking:

Montioring of part requirements is continuous throughout the cycle of an order. From the time an order is entered into the Master Production Schedule until its completion any changes (such as an increase in scheduled quantity of a major repairable component or a change in the requirements reported on the Material Requirements/Pick List document) are analyzed by MRP. MRP will produce action reports when: (1) shortage conditions occur, (2) suggested requisition status changes are not initiated on time, (3) material receipts are past due, or (4) other situations occur that require corrective action. These action reports are directed to the appropriate planner responsible for ordering the part identified on the report.

The status of parts on order is continually monitored by the MRP system. As each requisition is processed arrival dates are calculated, based on the purchase lead time of the part involved. If the part has not been received as of the calculated arrival date the system notifies the appropriate planner that immediate action needs to be taken. In addition, the effect of the delayed receipt on the related job orders is highlighted.

Unrecorded Assets

All material existing in the shop but not recorded by the MIS system will be collected, recorded and controlled by MRP. These goldpile parts will be segregated in physical locations separate from identical recorded asset parts and these locations will be referred to as "UA" (unrecorded asset) locations by the MRP system. The Shipyard MIS system will be able to monitor only the balances of recorded assets.

The MRP system will treat unrecorded asset parts similar to recorded asset parts, but will distinguish between the two in two basic ways:

(1) Goldpile locations and quantities will appear first on MRP generated picking documents and the Shop Stores clerk will have instructions to issue from exisitng UA locations first. As unrecorded assets are depleted, they will not be replenished. The Shipyard MIS system's visibility to actual balances will become more realistic over time as unrecorded assets diminish.

(2) During physical cycle counts unrecorded assets will be counted separately and will not be reconciled when comparing the MRP and MIS system balances (so no artificial out-of-balance situations will occur).

Message File

System messages are used to trigger analysis and reports through communication between system programs. A message relationship exists when exception conditions are detected by one application to be examined or resolved by another application. This is done through the use of communication messages between programs of the two applications.

The relationships between Inventory Control and the other MRP applications are summarized below:

INVENTORY CONTROL MESSAGE RELATIONSHIPS

APPLICATION	IC REQUIRES BUSINESS DATA	REQUIRES IC BUSINESS DATA	MESSAGE RELATIONSHIP
Design Engineering	X		
Requirements Planning		X	X
On-Line Inquiry		X	

The relationships between Requirements Planning and the other MRP applications are summarized below:

REQUIREMENTS PLANNING MESSAGE RELATIONSHIPS

APPLICATION	RP REQUIRES BUSINESS DATA	REQUIRES RP BUSINESS DATA	MESSAGE RELATIONSHIP
Design Engineering	X		X
Inventory Control	X	X	X
On-Line Inquiry		X	

The Part Master File and Product Structure File are created by Design Engineering and either maintained or used by Inventory Control. The Part Master File is maintained by Inventory Control, and is used by Requirements Planning, Inventory Accounting and On-Line Inquiry.

The Order Data Base, created and maintained by Inventory Control, is used by Requirements Planning and On-Line Inquiry.

The Inventory Control application sends messages to Requirements Planning on potential shortage or excess inventory conditions for parts requiring replanning. Following is a brief description of those messages passed between Inventory Control, Requirements Planning and Design Engineering.

Message File (continued)

From	To	No.	Brief Description
RP	IC	200	Order Analysis. Sent when either an order add or change is processed.
RP	IC	210	Sent if either of the following exception conditions occur on orders with a status other than planned: - Reschedule earlier - Increase quantity
RP	IC	220	Sent if an effectivity exception is encountered when exploding component requirements for an order change transaction.
IC	RP	310	Requirements Planning Analysis. Sent whenever a transaction is processed which could cause excess supply. Also whenever a shortage condition is detected.
DE	RP	310	Requirements Planning Analysis. Sent whenever there is a change in any factor that could change the order policy or order lot size.
IC	RP	310	Requirements Planning Analysis. Sent whenever a transaction is processed which could cause excess supply or whenever a shortage condition is detected.
DE	RP	320	Requirements Planning Replanning. Sent whenever changes are made to the Part Master File and Product Structure File data that could effect the calculation of planned order or component demand (e.g., make/buy code, change effectivity date, delete component, etc.).
DE	RP	330	Requirements Planning Reschedule. Sent whenever lead times are changed on the Part Master File.
IC	RP	340	Master Schedule Report Request. Sent to request master schedule reports for selected parts.
IC	RP	350	Master Schedule Change. Sent to print all master scheduled parts that have had a change.
IC	RP	360	Order Requirement/Planning Action Consolidation. Sent so that parts with exception conditions (on the day Requirements Planning is run) are printed only on the Planning Action report rather than on two different exception reports on the same day.

Message File (continued)

From	To	NO.	Brief Description
RP	SF	510	Order Delete. Sent when Requirments Planning needs to have an order deleted by Shop Floor Control.

INVENTORY PLANNING AND CONTROL MASTER FILES

Order Header File

The Order Header File contains information regarding the status of each job order and requisition order. The following data is included in the file: (1) the date the order was input into the system; (2) the order type, e.g., purchase order; and (3) the order status, e.g., planned, firm, cut, pick.

Requirement Detail File

The Requirement Detail File contains specific information on the supply and demand status of material for each job order. Information from this file is used to detect shortage conditions. The planned, firm, cut and pick dates for all parts are maintained in this file.

Order History File

The Order History File contains order information for each job order number. The file includes all parts in the overhaul of a carcass and shows the actual usage frequency of the parts.

APPENDIX D

LOCAL MR FUNCTIONAL DESCRIPTION

11ND-NSYLB-5230/172 (5-74)

LONG BEACH NAVAL SHIPYARD
DATA PROCESSING OFFICE

PROGRAM DESCRIPTION FORM

PROGRAM NUMBER MRC551	REVISION NUMBER 01	SOURCE LANGUAGE COBOL
PROGRAM NAME UPDATE INCOMPLETE HISTORY FILE (MRC5514 or MRC4521)		SUBMITTED BY LBNS

PROGRAM PURPOSE

Update incomplete History File MRC5514) for extraction of Material usage history data and other Material requirements.

PROGRAM DESCRIPTION

INPUT: Input includes

1. The incomplete Master Record file MRC4521 or MRC5514 in Job Order sequence (186 character record).
2. Card input, MR Transaction file, MRC5510 containing:
   a. Coar cards
   b. Job order cards

OUTPUT: Output includes

1. The incomplete History file, MRC5514, will be the same as the input record format (186 character record), in job order sequence.
2. The complete History file, MRC5511 is a 156 character record, in Job Order sequence (compressed).
3. The Job Order file, MRC5513, is in card format (80 characters) is in Job Order sequence.
4. The Reject file, MRC5512, is in card format (80 character record).

PROCESSING: Transaction file input is read and coded. COAR cards are coded with a "0", Job order cards are coded with a "1" in the first position of the sort key.

Card input is then sorted on the first position of the sort-key and the Job Order (positions 1-12).

COAR cards are validated on the Hull field, cc 73-80, for greater than spaces. If Hull field is valid, COAR cards are loaded into a table (100 entries maximum) to be matched against the incomplete History file.

If COAR cards are invalid they are written to the reject file and coded with an "R" in card column 11.

COAR cards update the Hull field only. A "D" in cc 12 in the COAR card will delete the entire COAR History record or records from the incomplete Master file.

Job Order cards are used to update, change or delete records on the incomplete Master file.

Job Order cards are validated for spaces in the mandatory fields. Job Order cards must have data in the following fields (with the exception of records with a "D" in cc 12);

1.	Mandays	Cols. 31-36
2.	Number of Units	Cols. 27-29
3.	SA,OR,OP,APL	Cols. 43-57
4.	Inst, Plan, Stk	Cols. 58-72

MINIMUM HARDWARE CONFIGURATION
REQUIRED BY SLAVE PROGRAM

______	CARD PUNCH	24	K CORE MEMORY
______	CARD READER	______	LINKS DISC STORAGE
______	PRINTER	6	TAPE HANDLERS

The SA,OR,OP, or APL field or the Inst, Plan, Stk field can have data in either field, but not necessarily both fields.
If Job Order record is found to be invalid it is written to the reject file and coded with an "R" in card column 11.
Job Order cards with a "C" in cc 12 will change the Job Order field only, of the incomplete Master file records.
Job Order cards with a "D" in cc 12 will delete the entire History record or records from the incomplete Master file.
A Job Order card file is produced for each Job Order written to the incomplete master file. This card is coded with an alpha character indicating which field or fields are missing in order to be passed to the completed History file (MRC5511), cc 37-41.
Codes are as follows:

1. H = Hull field missing cc 37
2. U = Number of units field missing cc 38
3. M = Mandays field missing cc 39
4. A = APL field missing cc 40
5. P = Plan field missing cc 41

Both APL and PLAN field must be blank to be coded.
The completed History file (MRC5511) is created from the Incomplete Master file. It is a compressed file.
The transaction date is converted from Gregorian to Julian.
The completed History File is then sent to Program NR. MRC560 to update the Job Order File.
A record count is provided for all input and output files.

SPECIAL INSTRUCTIONS

NOTE: IF MRC551 IS PROCESSED MORE THAN ONCE PRIOR TO PROCESSING MRC452, MRC5514 OUTPUT FILE WILL BE USED AS INPUT, IN LIEU OF MRC4521.

EACH TIME MRC551 IS PROCESSED, THE MRC5514 OUTPUT FILE MUST BE USED IN MRQ558 TO PRODUCE AN INCOMPLETE HISTORY REPORT BY COAR.

11ND-NSYLB-5230/172 (5-74)

LONG BEACH NAVAL SHIPYARD
DATA PROCESSING OFFICE

PROGRAM DESCRIPTION FORM

PROGRAM NUMBER MRC988	REVISION NUMBER 01	SOURCE LANGUAGE COBOL
PROGRAM NAME PRODUCE SUMMARY EXTRACT AND DATA FILE (MR REPORT GENERATOR)		SUBMITTED BY LBNS

PROGRAM PURPOSE

TO PROVIDE SCRATCH SHEETS FOR ORDERING MATERIAL IN ADVANCE OF A SHIPS ARRIVAL FOR REPAIR AND TO PRODUCE EXTRACT FILE TO UPDATE WANG DATA FILE.

PROGRAM DESCRIPTION

INPUT:	1.	SORTED EXTRACT FILE	MRC9851
	2.	SORTED JOB ORDER FILE	MRC5601
	3.	SORTED EXTRACT TRANS	MRC9751
OUTPUT:	1.	WANGFILE	MRC9881
	2.	RPTFILE	MRC9882

PROCESSING: SORTED EXTRACT TRANSACTION FILE IS LOADED INTO A TABLE (TABLE LIMIT IS 500 MAX).

DESIGNATOR 057 CONTROLS THE PROCESSING OF MRC988.

THE SORTED JOB ORDER FILE IS READ AND MATCHED BY EXTRACT TYPE TO THE EXTRACT TRANSACTIONS INPUT TABLE. WHEN A MATCH OCCURS "PART I" OF THE SCRATCH SHEET IS PRINTED WITH THE CARD IMAGE FROM THE TABLE AND THE MATCHING JOB ORDER RECORD OR RECORDS. THE COMPONENT AND MANDAY AVERAGE TOTALS ARE CALCULATED PER JOB ORDER AND PRINTED ON "PART I" OF THE SCRATCH SHEET. THESE TOTALS ARE USED IN CALCULATING THE AVERAGE QUANTITY FOR ITEMS WHICH MATCH THE CARD INPUT AND ARE EXTRACTED FROM MRC9851. ITEMS EXTRACTED FROM MRC9851 ARE PRINTED ON "PART II" OF THE SCRATCH SHEET IN "NIIN SEQ" AND IN NUMERICAL ORDER. THE WANGFILE IN CODE SEQUENCE IS CREATED FROM THE DATA EXTRACTED.

THE WANG FILE HAS 3 RECORD TYPES:

1. HEADER RECORD-(WANG-REC1) CONTAINS THE EXTRACT DATA MATCHED BY THE COMPLETED HISTORY FILE. WANG ITEM NUMBERS FOR HEADER RECORDS WILL ALWAYS SHOW ZERO (00000) WITH THE ADDITIONAL ELEMENTS, HULL NR., EXTRACT DATA TYPE ETC.
2. DATA ITEMS-(WANG-REC2) ALL ITEMS EXTRACTED FROM MRC 9851 IN "NIIN SEQ" AND IN CORRESPONDING NUMERICAL ORDER TO THE ITEMS PRINTED ON "PART II" OF THE SCRATCH SHEET.
3. TOTAL RECORD'(WANG-REC3) INCLUDES THE TOTAL NUMBER OF RECORDS EXTRACTED PER CODE, HULL NR. AND THE FILE IDENTIFICATION.

MINIMUM HARDWARE CONFIGURATION
REQUIRED BY SLAVE PROGRAM

	CARD PUNCH	25	K CORE MEMORY
	CARD READER		LINKS DISC STORAGE
X	PRINTER	5	TAPE HANDLERS

A TOTAL PAGE IS PRINTED AS THE NEXT TO LAST PAGE OF THE SCRATCH SHEETS, A LIST OF THE CODES (231, 232, 233, 234, 235, 236, 237, 238) AND THE NUMBER OF ITEMS EXTRACTED PER CODE.
THESE TOTALS ARE ALSO DISPLAYED ON THE EXECUTION REPORT.

A LIST OF UNMATCHED EXTRACT TRANSACTION RECORDS, MRC 9751, ARE PRINTED ON THE LAST PAGE OF THE SCRATCH SHEETS.

ALL EXTRACT TRANSACTION RECORDS ARE PRINTED ON THE EXECUTION REPORT AND UNMATCHED ONES ARE FLAGGED WITH AN ASTERISK.

1. The first record on the Sorted Extract Transaction file, MRC9751 is read. The file identification of the input Extract Master file is determined by the value in positions 30-31 of this first record:

POS. 30-31	Extract Label ID	Extract Name
AP	MRC5671	APL Master
ST	MRC5681	ST Master
All Others	MRC5691	OT Master

2. The MRC9751, Transaction file, is matched to the Extract Master on field "Extract-1". If positions 106-107 of the master do not equal positions 30-31 of MRC9751, the Job Stream is aborted, the message "MRC980 Extract Field DISAGREES" is displayed on Sysout, and "MRC980 JOB ABORTED" on the console.

3. Any MRC9751 records that do not have a matching record on the Master file are displayed on the sysout.

4. Each selected (matched) master record that has an FSC matching the values from 10 designators (sorted in an internal array) and that has position 2 of the NIIN not equal to "A" through "Z" is deleted. All other selected Master records are written to the Extract File, MRC9801.

APPENDIX E

FUNCTIONAL DESCRIPTION OF ARMIS

ARTEMIS SYSTEM OVERVIEW

This document describes the total information flow within the ARTEMIS REPAIRABLES MANAGEMENT SYSTEM from the receipt of a funding document (the equivalent of a purchase order) to final billing of all items on that funding document.

STEP 1 - Planning Department, Code 224, annotates funding document with schedule induction number (BSS) and the priority.

STEP 2 - Comptroller Officer, Code 620, receives a new Funding Document and enters all data that is consistent for all attached line items in the PRIME (CODS) computer system. The line items known as "COARS" (Customer Order Acceptance Record) are also entered in PRIME(CODS). All revisions or corrections to Funding Documents for COARS are made in PRIME(CODS).

STEP 3 - NITE 1 BATCH PROGRAM
This program is performed once a day, in the evening, a magnetic tape from PRIME(CODS) is passed to ARTEMIS containing three files.

CODS1 - Number of records contained in file CODS2. This is needed to create a "header" record on the file ARTEMIS passes to MIS each night.

CODS2 - MIS/COST transactions originating on the PRIME computer.

CODS3 - Entire live COAR file - as PRIME(CODS) sees it.

NITE1 does the following:
- * Purges the three files from the put/get cartridge.
- * Reads the current three files from the tape to the put/get cartridge (and translates them from EBCDIC to ASC11).
- * Signs onto ARTEMIS with batch file CODAR (CODS TO ARTEMIS) I. D. 600, PRO CODS.
- * Delets dataset COARS from library.
- * Erases CODS3 (from I. D.)
- * Get the new CODS3 and executes the file to bring the new "live" COARS into the dataset COARS.

STEP 4 - TAPE 1 BATCH PROGRAM
This program is performed once a day, in the evening. TAPE1 creates a file which will be passed to MIS via magnetic tape.

TAPE1 does the following:
- * Signs onto I. D. 622 PRO TAPER to check that it has not already been run, by comparting the Last Run Date (LRD) to today's date, and to erase files WCD1 and WCD2.
- * Signs onto I. D. 950, PRO RMS and executes file WCDER, which creates four different records which are passed to MIS, These records are: WCD Creation, WCD Rescedule, WCD Close, and WCD Open

These records are copied to file WCD2, file WCD1 contains a count of these records. Files WCD1 and WCD2 are moved to I. D. 622.

* Signs back onto I.D. 622, PRO TAPER and executes file CODCK, which looks for COARS that should get WES'S but are missing important field. File WESER is then executed, which merges CODS 1 (number of records passed to MIS from CODS), CODS 2 (records from CODS to be passed to MIS), WCD 2 (WCD transactions from Code 950), and WES records (generated by file WESER) into on file called TOPUN and sent to put/get area. LDR (Last Run Date) is now set to today.

STEP 5- TAPE 2 BATCH PROGRAM
This program is performed once a day, in the evening. TAPE 2 puts the file created by TAPE 1 onto magnetic tape. A printout is made of what is on the tape for filing in binder. The magnetic tape is sent to the MIS System.

STEP 6- This is the first step that is part of the "Job Status Tracking" module . Almost all steps in this module may be performed off-line via a series of programs written for the 2649 terminal as a stand alone processer or on line. We will deal only with the on-line methods.

Code 930 or 950 (Repairables Rework Center) selects option "A" on their Menu to create a Keyop (short for key operation). They enter the COAR number, the Keyop number they are creating, the date of induction (if no date is input, the default date is the actual date), and the number of units inducted. "Inducted" in this application means the RRC has requested a number of carcasses to be overhauled. A record is created in the dataset KOPS for each keyop.

STEP 7- The RRC's use option "B" on their Menus to report receipt of carcasses (the date carcasses are received and the number of carcasses). The record created in option "A" is reviewed and these two fields are entered. The receipt date marks the beginning of Repairable Turn Around Time (RTAT).

STEP 8- The RRC's use option "C" to report that carcasses have either been completed, surveyed, found to be wrong, etc. To accomplish this, they must enter the COAR, Keyop, transaction quantity, transaction date (this marks the end of RTAT) and the transaction flag (how did it leave? complete, scrapped, etc.).

STEP 9- This step and the next one are only performed when repair work on a carcass is interrupted due to a lack of parts (referred to as "G" condition). The user (RRC) will use option "D" to put a carcass in "G" condition). This creates a record in the "GITMS" dataset.

STEP 10- When the parts which held up the repair effort arrive, the user uses option "E" to report to the system the date the carcass returned to "M" condition.

STEP 11- option "H" on the RRC Menu will A (proof carcass transactions and B) "roll up" transactions to Keyop level. Among the checks made are A) the Keyop has been established, B) no more carcasses are being reported leaving the shop floor than were received against that Keyop, C) the transaction flag is either "A", "B", "F", "H", "J", "K", "P","W", or D) the date the carcass was reported leaving is after the date the carcass was reported received.

STEP 12- NITE2 or TUESD or FRIDY BATCH PROGRAM
This step is performed once a day, in the evening, On Tuesday the TUESD batch program is performed instead if NITE2. On Friday the FRIDY batch program is performed instead of NITE2.

NITE2 does the following:

* Enters new COARS from PRIME (CODS) in to the correct I.D. (930 or 950) JOBS dataset.
* performs all RRC roll up transactions to the COAR level and RTAT calculations in each I.D. (930 & 950).
* Replaces JOBS dataset in I.D. 900 with updated JOBS dataset from I.D. 930 and I.D. 950.
* Enters new COARS from PRIME (CODS) into I.D. 600, PRO CODS dataset COST.

TUESD does the following:

* Performs the functions listed under NITE2.
* Performs six checks and any errors found are spooled on six error reports.

FRIDY does the following:

* performs the functions listed under NITE2.
* Enters I.D. 622, PRO TAPER and prepares depot report for Code 630.21 and spools report.

STEP 13 - XOVER BATCH PROGRAM
This program is run once a week on Friday after all NITE programs have been run.

XOVER does the following:

* Enters I.D. 224, PRO RMS and executes current STBR file, which enters current stablized rates in STDT dataset.
* Saves the following I.D.'s 100,110,224,621,622,900 on disk.
* Enters I.D. 100 PRO RMS overlays datasets STDT and SHOPS with current STDT and SHOPS datasets from I.D. 224.
* Executes file ARCOD, which copies out standards data to a file and sends file to put/get area. File TPCOD puts this data on magnetic tape. This tape is sent to the PRIME (CODS) system to update their standards database.

STEP 14 - COST PROGRAM
This program is run once a week on Monday morning.

COST does the following:

* A magnetic tape is received from MIS with current cost information. File: TOUS enters this data into put/get area.
* File COST gets data from put/get area and enters data into dataset COST in I.D. 600, PRO CODS.
* Executes file FDRPT which prints the Funding Document Report.

STEP 15 - EOMER PROGRAM
This program is run once a month.

EOMER does the following:

- Enters I.D. 930 and I.D. 950 and executes file HISTR.
- File HISTR creates historical file which contains records from JOBS dataset where COR has a charge code of Z in COARS dataset.
- These historical files are moved from respective I.D.'s to I.D. 600, which are then entered into dataset HIST.
- Enters I.D. 224 PRO RMS and executes file PCRPT then spools report.
- Enters I.D. 900 PRO RMS and prepares reports CLOS2, CLS2A, and OVREX.
- Enters I.D. 930 and I.D. 950 to execute file CL9X0.
- File CL9X0 prints report of records which will be deleted in datasets JOBS, KOPS, TRNS, and GITMS. These records are then deleted.

APPENDIX F

SAMPLE ARMIS REPORTS AND FORMS

```
                                                                                         PAGE  79
                    2S CINCLA REFIT REPORT

                                                                      REPORT SYMBOL: NAVSEA 4440/1
------------------------------------------------------------------------------------------------------
1.TO:                                                 : 2.REPORTING ACTIVITY       : 3.REPORT PERIOD    : 4.SIGNATURE
  COMMANDER, NAVAL SEA SYSTEMS COMMAND, WASHINGTON DC : LONG BEACH NAVAL SHIPYARD :     1-31 JANUARY 85
  20362  ATTN: CODES 51F/52F/53F/54F/0413/62YG/62XL   : CODE 224/620/930/950       :  PREPARED 31-JAN-85
------------------------------------------------------------------------------------------------------
FUNDING :      NOMENCLATURE         :NATIONAL   : LOCAL JOB  :START :   QUANTITY    : %  : COMP : FUNDS :  FUNDS    :
DOCUMENT:        BSS NR.            :STOCK NO.  : ORDER NO.  :DATE  :AUTH:SCHD:COMP:COMP: DATE :  AUTH :  EXPEND   :      REMARKS
------------------------------------------------------------------------------------------------------
82-PO   PACKARD 20850R3 185         2S   2815- 64D8P-32S37             1   1   0     0          59,000   S   31867   BSR=  0
4A111   NWPN232069X15200            00-5801087    A                                                     A   80008   WRONG MATL=  0
2023                                                                                                                SURVEY=  0
                                                          IN WORK IN SHOP=  1                                       'G' COND=  0
        COMMENTS:  NO CRANK
------------------------------------------------------------------------------------------------------
82-PO   PACKARD 20850R3 185         2S   2815- 64DBY-32S37             2   2   1    50         118,000   S  114090   BSR=  0
4A111   NWPN23-2132-K154            00-5801087    A                                                     A   98080   WRONG MATL=  0
2040                                                                                                                SURVEY=  0
                                                          IN WORK IN SHOP=  1                                       'G' COND=  0
        COMMENTS:  COMPLETED S/N 208-R3 6/3/84
------------------------------------------------------------------------------------------------------
83-PO   PROP SHAFT MS0421           2S   2010- 64FCJ-32S37  830512     1   1   0     0          44,200   S   35515   BSR=  0
4A111   NWPN23-2355-K153            00-8235052    A                                                     A   21534   WRONG MATL=  0
2002                                                                                                                SURVEY=  0
                                                          IN WORK IN SHOP=  1                                       'G' COND=  0
        COMMENTS:
------------------------------------------------------------------------------------------------------
83-PO   MS0421CL PROP SHAFT         2S   2010- 64FCK-32S37             1   1   0     0 850121   44,200   S    6108   BSR=  1
4A111   NWPN23-2355-K150            00-0885075    A                                                     A    3415   WRONG MATL=  0
2001                                                                                                                SURVEY=  1
                                                          IN WORK IN SHOP=  0                                       'G' COND=  0
        COMMENTS:
------------------------------------------------------------------------------------------------------
83-PO   PROP SHAFT MS0421           2S   2010- 64FCZ-32S37  840210     1   1   1   100 850130   44,200   S   41601   BSR=  0
4A111   NWPN23-3215-K151            00-8235052    A                                                     A   25651   WRONG MATL=  0
2002                                                                                                                SURVEY=  0
                                                          IN WORK IN SHOP=  0                                       'G' COND=  0
        COMMENTS:
------------------------------------------------------------------------------------------------------
83-PO   PACKARD ID1700 MAIN         2S   2815- 64DDT-32S37  830622     1   1   0     0         107,053   S   51868   BSR=  0
4A211   NWPN23-3130-K150            00-5801299    A                                                     A   72619   WRONG MATL=  0
2011                                                                                                                SURVEY=  0
                                                          IN WORK IN SHOP=  1                                       'G' COND=  0
        COMMENTS:  NO CRANK
------------------------------------------------------------------------------------------------------
```

```
COAR LISTING - ALL COARS ON N00024-85-WR03318     COG IS 2F
     RUN ON 20-MAY-85        EXPIRED 30-SEP-85

          SORTED IN YR FD COAR SEQUENCE
          ------ -- -- -- ---- --------

C        ITEM          UNIT           AUTH.                                                MAN      MAN
H         NO.  C   NIIN AUTH UNITS    FUNDS     LABOR      MATL     ACTUAL      STAB      HRS      HRS
R  COAR  ITM   C   NIN   URQ  COMP     CFA       EXP        EXP       EXP        EXP      ALLOW    EXP
-  ----  ---   -   ---   ---  ----     ---       ---        ---       ---        ---      -----    ---

A 67WND 3001 01 0255831   1     0     11,000     8,051       429     8,480     13,060      244      234

A 67WNE 3002 00 3462139   1     0      6,500     1,858     2,668     4,526      3,432      113       62

C 67XJG 3003 00 4611506   1     1      1,500       840        32       873      1,249       20       22

A 67XJH 3004 01 0640194   1     1        500       606        17       622        908        9       16

C 67XJJ 3005 01 0640194   1     1        500       270       430       700        414        9        7

                    ********************TOTALS FOR N00024-85-WR03318 ********************

                         TOTAL FUNDS AUTHORIZED                       20,000
                         TOTAL FUNDS COMMITTED                        20,000
                         TOTAL FUNDS EXPENDED (ACTUAL)                15,201
                         TOTAL FUNDS EXPENDED (STABALIZED)            19,064
                         TOTAL FUNDS REPROGRAMABLE                         0

                           ACTUAL NUMBER OF LINE ITEMS ON FUNDING DOCUMENT       5

                    **********************************************************************
```

```
               CODE 966 REPAIRABLES CLEARANCE/INDUCTION SHEET
               **** *** *********** ******************* *****

MANHOURS= 32                                               ORIGNATOR=FREY

START=  9-16-85                                              PHONE= 6289

COMPL=  10-18-85                                             PREPARED=18-JUL-85

INDUCTION DATE         FUNDING DOCUMENT        INDUSTRIAL CONTROL NO.      KOP
********* ****         ******* ********        ********** ******* ***      ***
     9 Sep 85          85          P003149     67KWH77H66                  420

COG   FSC   CC   NIN        INDUCTION QTY       LEAD SHOP        DOCUMENT NUMBER
***   ***   **   ***        ********* ***       **** ****        ******** ******
 7H   5840  00 5739940                  4        6611          NWPN35-5181-9883

    FOREMAN                                                         5291
    *******
PEARSON

MFR.
****
21877

PART NUMBER
**** ******
1882757



NOMENCLATURE
************
SPS-40B AMP 5A11

INVPRICE
********
2900.00
```

REPAIRABLE LOG SHEET
N00104 85 P003144 7G
EXP I 31-JUL-86

REPORT: LOCRP

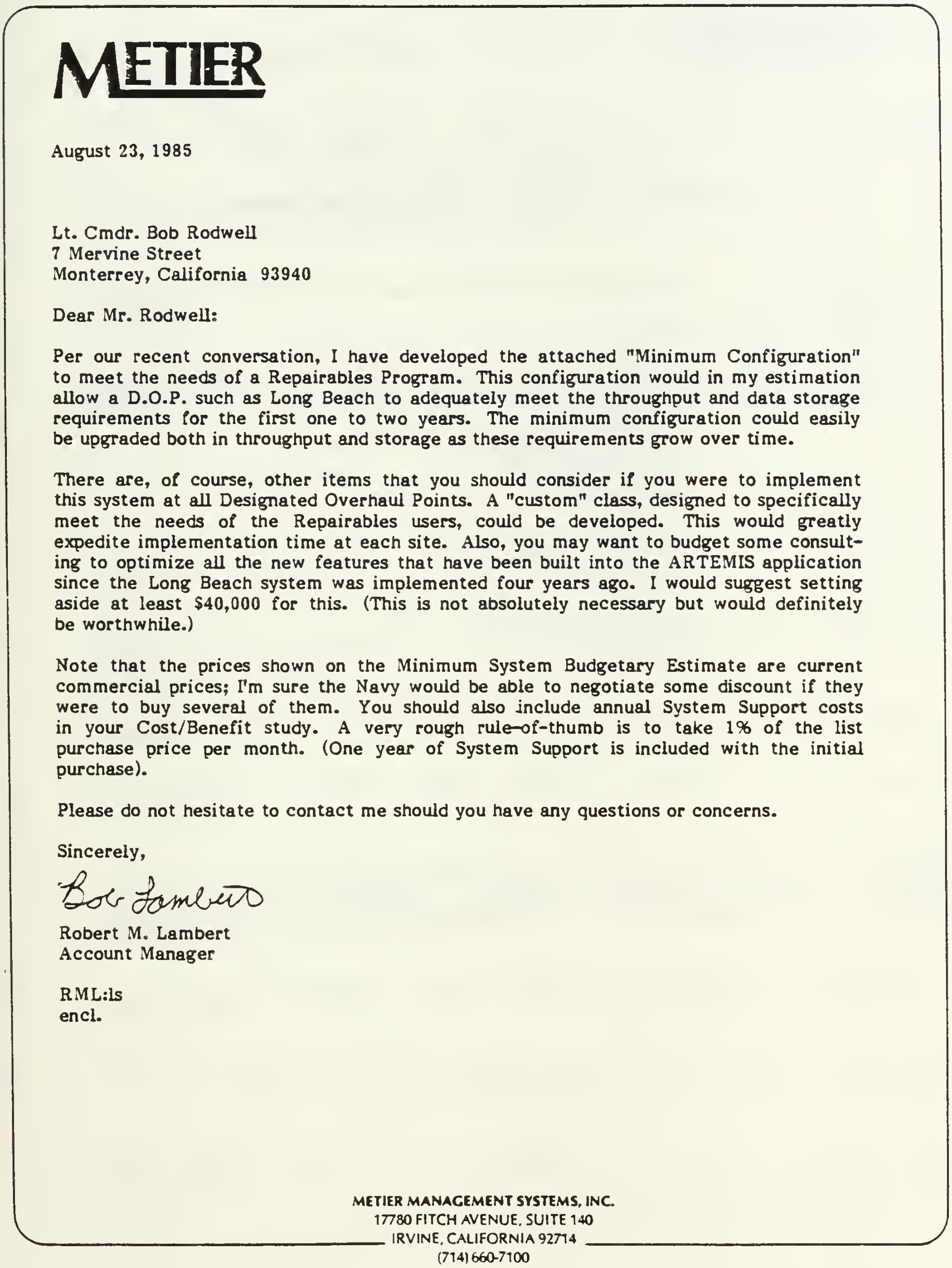
FISCAL YEAR/QUARTER

ITEM	NOMENCLATURE NSN NSS NO.	AUTH QTY	TOTAL REPAIR COST	JOB ORDER	MH EST.	DOLLAR EST.	JOB ORDER ISSUE QTY	JOB ORDER ISSUE MH	JOB ORDER ISSUE DATE	KEY OP QTY	KEY OP DATE	DATE SCHED COMP	DATE 620 CLOSE
3001	ASTRONOMIC RECORDER 6625 00 0182184 NWPN35-5181-9449	1	1733	66DXL77G66	39	1733	1	38	7/5/5	1	8/7/5	9/20/5	
3002	SRC-16 SWITCH CONTROL 5820 00 0868974 NWPN35-5181-9450	2	830	66EAN77G66	16	830	2	14	7/5/5	2	8/20	9/20/5	
3003	OSCILLATOR 6625 00 0896697 NWPN35-5181-9451	1	978	66DXM77G66	22	978	1	21	7/5/5				
3004	AC/DC METER CALIB 6625 00 1072098 NWPN35-5181-9452	1	1955	66DXN77G66	44	1955	1	4.5	7/5/5	1	7/30/5	10/25/5	

```
*******************************************************************************************

              REPAIRABLES HISTORY FOR 7H 6685 00 0014179
                                      CONTROL, FUEL RATIO
                                      GEN REGULATOR MODEL 1803

                           AVE     AUTH      STAB      ACT     BSR                                  G     NBR     DATE       ENTERED
 COAR COG  UCP    EST      MHE     FUND      EXPD      EXPD    QTY    RT1     RT2     TAT    RTAT   COND  KOP   COMPLETED   HISTORY

70MJV   7H     1   27     50.0    961.00   1759.23   1307.00     0    1.0     0.0     3.0     3.0    0.0     1   8-SEP-80   7-DEC-81

62CAA   7H     8   27     25.6   7564.00   7195.76   7622.00     0    0.0     0.0   127.0   127.0    0.0     1   3-MAR-81   7-DEC-81

62CBJ   2H     3   27     45.3   4740.00   4766.80   4465.77     2    3.5     0.0    45.0    45.0    0.0     2  10-APR-81   1-DEC-81

62CCP   7H     6   27     26.0   5577.00   5577.01   4638.25     0    8.5     2.5    41.5    41.5    0.0     2  19-OCT-81  30-JAN-82

64NAA   7H     1   27     24.0   1102.00    942.01    537.75     9    6.0     0.0   105.0   105.0    0.0     1  17-APR-82   3-SEP-82

64NBJ   7H     6   27     25.4   6612.00   5985.63   6172.65     1    4.0     0.0    70.0    70.0    0.0     2  27-JUL-82   3-JUN-83

64NCJ   7H     0   27      0.0      0.00      0.01      0.15     4   10.0     0.0     0.0     0.0    0.0     1  29-JUL-82   3-JUN-83

64NFT   7H     0   27      0.0      0.00      0.01      0.15     6    0.0     0.0     0.0     0.0    0.0     1  22-APR-83   8-DEC-83

64NDL   7H     3   27     29.0   3306.00   3692.29   3112.15     1    7.0     0.0   189.0   189.0    0.0     1  22-AUG-83   8-DEC-83

64NEW   7H     1   27     26.0   1192.00   1130.49    885.95     5    4.0    69.0   313.0   313.0    0.0     1  18-JAN-84   2-MAY-85

64NLX   7H     0    0      0.0      0.00      0.01      0.15     5    0.0     0.0     0.0     0.0    0.0     0   1-OCT-84   7-FEB-85

64NKH   7H     0   27      0.0      0.00      0.01      0.15     3    0.0     0.0     0.0     0.0    0.0     1  17-OCT-84   4-APR-85

64NHG   7H     5   27     24.6   5960.00   5583.48   7093.95     0   12.0     4.0   177.4   177.4    0.0     2  12-DEC-84   4-APR-85


            HISTORY SUMMARY
  34.0  UNITS COMPLETED IN   13.0  JOBS
AVERAGE RTAT IS  108.7  DAYS.  AVERAGE TAT IS  108.7  DAYS
AVERAGE TIME TO INDUCT IS    6.5  DAYS; TIME TO START WORK IS    6.3  DAYS
ESTIMATE IS   27  MANHOURS.  AVERAGE MANHRS PER COMPLETION IS   28.2  MANHOURS
GAIN/LOSS PER UNIT COMPLETION HAS BEEN  $     11.80
AVERAGE GAIN/LOSS PER JOB HAS BEEN $    30.87


*******************************************************************************************
```

APPENDIX G

ARMIS HARDWARE AND TRAINING COST ESTIMATES



METIER

August 23, 1985

Lt. Cmdr. Bob Rodwell
7 Mervine Street
Monterrey, California 93940

Dear Mr. Rodwell:

Per our recent conversation, I have developed the attached "Minimum Configuration" to meet the needs of a Repairables Program. This configuration would in my estimation allow a D.O.P. such as Long Beach to adequately meet the throughput and data storage requirements for the first one to two years. The minimum configuration could easily be upgraded both in throughput and storage as these requirements grow over time.

There are, of course, other items that you should consider if you were to implement this system at all Designated Overhaul Points. A "custom" class, designed to specifically meet the needs of the Repairables users, could be developed. This would greatly expedite implementation time at each site. Also, you may want to budget some consulting to optimize all the new features that have been built into the ARTEMIS application since the Long Beach system was implemented four years ago. I would suggest setting aside at least $40,000 for this. (This is not absolutely necessary but would definitely be worthwhile.)

Note that the prices shown on the Minimum System Budgetary Estimate are current commercial prices; I'm sure the Navy would be able to negotiate some discount if they were to buy several of them. You should also include annual System Support costs in your Cost/Benefit study. A very rough rule-of-thumb is to take 1% of the list purchase price per month. (One year of System Support is included with the initial purchase).

Please do not hesitate to contact me should you have any questions or concerns.

Sincerely,

Bob Lambert

Robert M. Lambert
Account Manager

RML:ls
encl.

METIER MANAGEMENT SYSTEMS, INC.
17780 FITCH AVENUE, SUITE 140
IRVINE, CALIFORNIA 92714
(714) 660-7100

METIER

REPAIRABLES MANAGEMENT PROGRAM

BUDGETARY ESTIMATE - MINIMUM CONFIGURATION

Model Number	Qty.	Description	List Price
6401	1	ARTEMIS System, including: • 6401 Processor • Scheduling and Relational DBMS Software • 65 MByte Disc Drive • Basic Terminal • Basic Printer	$230,000
(4502)	(1)	DELETE Scheduling DBMS	(30,000)
3233	1	800/1600 BPI Tape Drive	18,000
3425	1	300 LPM Printer/Plotter	7,500
3401	3	Basic Terminal	4,725
			$230,225

LIST OF REFERENCES

1. Naval Audit Service Western Region, Repairables Management Audit Report C13549, 15 Apr 1985.

2. Naval Audit Service Western Region, Repairables Program Audit Report C13759, 29 Jan 1985.

3. Chief of Naval Material Instruction 4440.14B, Navy Repairable Management Manual, 17 Feb 1982.

4. Miss Amie Burrison, NAVSUP Code 063, interview 23 Sep 1985.

5. Naval Supply System Command Publication 553, Inventory Management, A Guide to Requirements Determination in the Navy., Sep 1984

6. Mr. Mike Beliveau, SPCC Code 0503E, interview 23 Sep 1985.

7. Mr. Ray MacDaniels, NSY Charleston Code 212, interview 26-27 Sep 1985.

8. Mrs. Cathy Schieber, NSY Mare Island Code 215, interview 9 Aug 1985.

9. Mr. Jan Sipe, SPCC Code 035, interview 23 Sep 1985

10. Mr. Eddie Belcher, NSY Norfolk Code 214, interview 25 Sep 1985.

11. Naval Sea Systems Command, Naval Electronic Systems Command, Repairables Rework Study, Phase 1 Report, Description of Repairables Workload and Repair Facilities, June 1976.

12. Mr. Leroy Brinson, NSY Norfolk Code 966, interview 25 Sep 1985.

13. Mr. Ed Fry, NSY Long Beach Code 950.1 RRC, interview 23 Aug 1985.

14. Mr. Steve Myers, NSY Norfolk Code 214, interview 25 Sep 1985.

15. CDR. Mike Jenkins U.S.N., SPCC Code 0503, interview 23 Sep 1985

16. Mr. Russ Mayes, FMSO, telephone interview 23 Sep 1985.

17. Mr. Art Green, NSY Long Beach Code 224, interview 23 Aug 1985.

18. Mrs Trudy Gasque, NSY Charleston Code 521, interview 27 Sep 1985.

19. Mr. Bob Sabol, NSY Long Beach Code 224, telephone interview, 14 Nov 1985.

20. CAPT. H. Rice, U.S.N., NSY Long Beach Code 500, interview 22 Aug 1985.

21. Mr. Vic Gray, NSY Long Beach Code 966, interview 23 Aug 1985.

22. Mr. Carlos Crespo, SPCC Code 035, interview 23 Sep 1985.

23. Mrs. M. Ramierez, NSC Annex Long Beach, telephone interview, 14 Nov 1985.

24. Mrs. C. Mahn, NSC Annex Mare Island, telephone interview, 14 Nov 1985.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93943-5100	2
3.	Commander (Code 071B) Attn: Mr. David Greemore Naval Sea Systems Command Washington, D. C. 20632-5101	2
4.	Commanding Officer (Code 035) Attn: Mr. Jan Sipe Navy Ships Parts Control Center P. O. Box 2020 Mechanicsburg, Pennsylvania 17055	1
5.	Commanding Officer (Code 0503) Attn: Commander Mike Jenkins, SC, USN Navy Ships Parts Control Center P. O. Box 2020 Mechanicsburg, Pennsylvania 17055	1
6.	Commanding Officer (Code 224) Attn: Mr. Art Green Long Beach Naval Shipyard Long Beach, California 90822	2
7.	Commanding Officer (Code 212) Attn: Mr. Ray MacDaniels Charleston Naval Shipyard Charleston, South Carolina 29408	1
8.	Commanding Officer (Code 510) Attn: LCDR J. R. Rodwell, SC, USN Charleston Naval Shipyard Charleston, South Carolina 29408	3
9.	Commanding Officer (Code 215) Attn: Mr. Dave Rich Mare Island Naval Shipyard Vallejo, California 94592-5100	1
10.	Commanding Officer (Code 214) Attn: Mr. Eddie Belcher Norfolk Naval Shipyard Portsmouth, Virginia 23709-5000	1
11.	Commanding Officer (Code 0503) Attn: LCDR Dick Gormly, SC, USN Navy Ships Parts Control Center P. O. Box 2020 Mechanicsburg, Pennsylvania 17055	1
12.	Professor Allan W. McMasters Department of Administrative Sciences (Code 54MG) Naval Postgraduate School Monterey, California 93943-5100	3

13.	Professor P. M. Carrick Department of Administrative Sciences (Code 54CA) Naval Postgraduate School Monterey, California 93943-5100	2
14.	Mr. Ed Lovelace 2330 Golden Avenue Long Beach, California 90806	1
15.	Curricular Office (Code 36) Naval Postgraduate School Monterey, California 93943-5000	1
16.	Defense Logistics Studies Information Exchange US Army Logistics Management Center Fort Lee, Virginia 23801	1

216919

Thesis
R6734
c.1

Rodwell
Reducing repair turn around time of depot level repairables at naval shipyards.

thesR6734
Reducing repair turn around time of depo
3 2768 000 65628 4
DUDLEY KNOX LIBRARY